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A Nineteenth Memoir on the Law of Storms in the Indian and China Seas, being the Cyclones of the Sir Howard Douglas *and of H. M. Brig* Jumna *in the Southern Indian Ocean. January to April,* 1848. *By* Henry Piddington, *President of Marine Courts.*

The Cyclones forming the subject of this Memoir are of special interest, as they occurred in the Storm Tract to which I have so often drawn the attention of navigators in the Eastern Seas, and the documents collected afford us good and tolerable data for the tracks. For the documents of the *Sir Howard Douglas'* Cyclone, I am principally indebted to Capt. Twynham, P. and O. Steam Navigation Company's Agent at Point DeGalle, and to J. Stuart, Esq., of Bombay. But on the other hand it should be stated that though subsequent to the *Jumna's* Cyclone there were at one time *eighteen* dismasted or cargo-damaged ships lying in the harbour of Port Louis, in the Mauritius, a Captain of one of them who was most zealously desirous of obtaining information for me and applied personally to every one of the Masters, could only obtain one or two Logs! and this is to be the more regretted as this Cyclone it will be seen throws a new light on the science, and is moreover peculiarly instructive for that dangerous tract of the ocean.

PART I.

The Sir Howard Douglas' Cyclone.

Extract from the Log of the Barque Isabella Blyth *from Calcutta towards London.—From Capt.* H. P. Baylis, *Ship time.*

Thursday, 13th January, 1848.—Noon. The N. W. monsoon experienced the last few days getting very light and variable, as though we should soon lose it.

Bar. 29.92; Simp. 29.75; at which they have stood for some days.

	Noon.
Lat.....	8° 4′ south.
Long. by Chron.....	89° 07′ E.
Do. Lunars.....	89° 03′.

Friday, 14*th January*, 1848.—First part light N. W. breeze, shifting suddenly at 5.30 P. M. to east and soon after E. S. E. leading us to hope we had the S. E. trade.

Midnight moderate at east becoming however light and variable. A heavy swell from the westward.

	Bar.	Simp.	Ther.
8 P. M.	29.91	29.76	83.
Noon	29.88	29.75	84.

Noon.

Latitude,..... 9° 22′ S.
Long. by Chron. .... 88° 39′ E.
Do. Lunars, ... 88° 47′.
Course and Dist. S 20 W. 84 miles.

Saturday, 15*th January*, 1848.—First part light baffling airs with gloomy showery weather settling down about 8 P. M. into the S. E. trade.

A very confused heavy swell from the west meeting a lesser swell from the eastward causing the ship to be very uneasy. *Should think it must have been blowing hard somewhere to the westward.*

	Bar.	Simp.	Ther.
8 P. M.	29.90	29.80	82
Noon, ...	29.91	29.81	82½

Noon.

Latitude,..... 10° 59′ South.
Longitude, ... 87° 25′ East.
Course and Dist. made S. 37 W. 121 miles.

Experienced a current these 24 hours of 37 miles setting S. 79 W.

On the 16th, weather still unsettled and in 12° 38′ S.; and 85° 25′ east; with a heavy N. W. swell throughout.

In his letter to me Capt. Baylis says, "from the 13th to the 17th January, 1848, a hurricane or severe gale must have been at no very great distance from me as is proved by the circumstance of the *Sir Henry Pottinger* cutting away her foremast in a hurricane on the 14th January in Lat. 9° S; Long. 83° 0′ East. I being on the same day in Lat. 9° 22′ S.; Long. 88° 39′ east; distant from him S. 86° east; 339 miles."

Captain Baylis wrote from London to Liverpool to obtain the Log of this ship and the John Bull* but had no reply from either of the commanders!

Ship WELLESLEY, *Capt.* ARROW, *from Calcutta to England.*

Copy of Capt. ARROW'S *Private Log.*

On 10th January, 1848, in 6° 26′ S.; Long. 87° 12′ E.; Bar. 29.96; Simp. 29.36; Ther. 81°. A long swell from west and westerly breeze.

11*th January.*—From 10th, Course S. 23° E. 134′; Lat. 8° 29′ S.; Long. 88° 14′ E.; Bar. 29.94; Simp. 29.30; Ther. 83°. Squally fresh breeze S. W. and fine with a heavy head sea.

* I have obtained no account of what occurred to them.

Wellesley, January, 1848.

		Course and Dist.	Lat.	Long.	Ther	Bar.	Simp.
12*th*.	First and middle parts @ S. W. very squally and unsettled W. and high sea from S. ship pitching deep. Latterly increasing to fresh gale @ N. W. with very heavy cross sea both from S. and S. W. heavy lurid appearance and continued heavy rain, making preparations for bad weather.	Per D. R. S. 4° W. 134′	10°.42′	87°.55′	81°	9 A. M. 29.82	29.30
						3 P. M. 29.68	29.14
13*th*.	First fresh gale @ N. W. with heavy head sea on and constant rain 4 P. M. drawing @ N. E. with heavy confused and following sea, shipping much water set reefed foresail. Midnight blowing a hard gale @ E. N. E. furled all but treble reefed main topsail and hove to. Latterly moderate @ E. fine, bore up @ S. S. W. and made some sail.	S. 20° W. 120′	12°.42′	87°.16′	83°	3 P. M. 29.70	29.20
						29.74	29.20
						9 A. M. 29.84	29.28
14*th*.	First part out 2nd reefs of courses, steady breeze @ S. E. with high sea and passing showers; 8 P. M. increasing with dirty appearance. In 2nd reefs and reefs of courses, middle blowing fresh at times with squalls and rain and high sea. Latter moderate S. E. breeze and fine out 2nd reefs of courses. Ship knocking about much and taking much water over all.	S. 37° W. 190′	15°.05′	85°.20	82°	3 P. M. 29.80	29.20
						29.94	29.40
						9 A. M. 29.92	29.36
15*th*.	First part steady fresh breeze @ S. E. with every appearance of the trade, out all reefs. Middle part light with passing showers: latterly strong breeze and cloudy and heavy following sea.	S. 62° W. 214′	16°.45′	82°.04′	81°	29.86	29.30
						29.98	29.44

N 2

Memorandum on Capt. ARROW'S *Diagram Chart.*

Breeze commenced at S. W. on the 10th and on 11th, at noon was strong and squally at S. W. with head sea, Bar. 29.90; we must have entered into the storm on its N. W. quadrant; Steering south we gradually fell behind it; weather getting worse; and at noon on 12th we were immediately behind it with fresh gale at N. N. W.; and heavy cross sea at S. W. marking where it had passed before: Bar. 29.65; this both from Bar, and the diagram appears to have been our nearest approach; still keeping on S. S. W. course till midnight, when we hove to under treble-reefed main topsail with hard gale at E.N.E. when it got away from us and (at noon) we had on the 13th strong easterly breeze and heavy sea at S. E. Bar. 29.82; we then kept away at S. W. and found the weather rapidly moderating but heavy confused seas on, and at noon on 14th appeared to have got the S. E. trade steady but with high easterly sea. Bar. at 29.90; and rising.

Abridged Log of the ship Sir HOWARD DOUGLAS, *Capt.* OGILVY, *from Newport towards Bombay.—Reduced to Civil Time.*

From Noon 13*th to Noon* 14*th January,* 1848, the course and distance were North 149′. with the wind E. b. S. strong gales and squally. At noon 14th Lat. 14° 18′ S.; Long. 80° 49′ E.; Bar. 29.54; Ther. 78°. P. M. midnight strong breezes E. S. E. course N. b. E.; double-reefed topsails.

15*th Jan.*—Close reefing, wind and course as above. Noon strong gales and heavy squalls. Course N. 8° W. 170′; Lat. 11° 30′ S.; Long. 80° 24′ east; Bar. at 8 A. M. 29.53; Ther. 75°; noon 29.41; Ther. 75°. P. M. wind S. E. course N. N. W., making preparations for bad weather. Bar. 8 P. M. 29.41; Ther. 73°; midnight 29.41; Ther. 70°; position at midnight about 10° 10′ S.; 79° 49′ east.

16*th Jan.*—Midnight running to the N. N. W. wind about east, called all hands to heave the ship to. Hurricane came on so quick that the foresail and foretopmast staysail were blown away and the ship broached too. Impossible to go aloft; 1 A. M. a tremendous hurricane. Cargo (of coals) shifted; the sea up to the hatches and breaking over all; Bar. to daylight 29.50; Ther. 72°. Wind is said to have veered from E. b. N. to N. N. E. and N. b. E. and then by the west to southward about noon as well as could be observed. Between midnight and noon lost mizen mast and rudder head, so as to leave nothing but the fore and main masts standing. Ship lying with her gunwale in the water from the shifted cargo. 4 P. M. wind about S. S. W. moderating very rapidly.

Midnight moderate with a very heavy sea. Bar. at 8 A. M. 29.53; noon 29.57; midnight 29.60; Ther. from 73° to 76°.

The Ship VICTORIA, *Capt.* POTTER, *from Calcutta bound to the Mauritius.*

Was in about 8° S. Lat. Long. about 80° East when a severe gale commenced P. M. on the 15th January (apparently from the westward). At midnight increasing. At 9½ A. M. a hurricane; lost foretopmast, and main mast, pumps crushed,* 1200 bags of rice thrown overboard, and much other damage done. Barometer about noon 29.47; 29.37, Wind veered from West A. M. to N. W. at noon and to N. N. W. and North. Bar. 29.38 and 29.30. By midnight Bar. had risen to 29.60 and 29.52; and on the 17th weather gradually moderated.

The above is all (that is essential to our purpose) to be deduced from a long account in the newspapers, which, though detailing at length the appearances of the weather and the ship's disasters, does not give positions, wind, courses or distances, or any other data of use to us. We are thus reduced to suppose that she may have been not far from 10° south; and 80° east when close to, but in the rear of the centre, but this is but very vague guessing. The ship being subsequently lost before she returned to Calcutta I was unable to procure her Log.

Abridged Extract from the Log of the Ship ADMIRAL MOORSOM, *Capt.* T. MCGILL, *from England to Colombo. Reduced to Civil Time. Forwarded by Capt.* TWYNHAM.

The *Admiral Moorsom* was at noon, 15th January, in Lat. 11° 2′ S., (Long. not given but about 79° east,) running to the N. b. E. with the wind at S. E. and squally, with close threatening weather, the rate of run is not given. 8 P. M. wind gradually veering from S. S. E. to S. S. W. at midnight, being exactly south at 10. Increasing fast throughout.

16*th Jan.*—At midnight the sky became very black and lowering with constant heavy rain. The Barometer which had been gradually falling all the evening now fell with alarming rapidity,† and the wind had increased to a very heavy gale: kept the ship right before the wind which (A. M.) had veered to S. W. Sea very high. 1 A. M. hove to, all sails blown away. 2 A. M. wind W. S. W. 3, West; violent hurricane from 3 to 5; 4. A. M. wind W. N. W. Sprung bowsprit and lost foretopmast. 5 A. M. wind N. W.; 6, N. W. b. W.; 7, wind N. N. W. 8, N. b. W. 9, North. 10, N. b. E. and at 12, N. E. much abated; by the evening moderate breeze at E. S. E.

* The second instance of this most dangerous accident: See remarks in Fourth Memoir, Journ. Vol. x.

† See remark at the close of the Log.

Remarks.—On the evening before the hurricane the air was exceedingly close, and so hot that it was difficult for any one to remain below in the ship. The Barometer fell gradually all the evening till 1 A. M. it then came down a full half inch in about 45 minutes, but at the same time the hurricane was upon us. It blew with the greatest fury between 3 and 5 o'clock; wind West to N. W. Lowest range of the Barometer 29.03 at 3 P. M. It soon after began to rise as fast as it had previously fallen.

The estimated position of the ship during the height of the hurricane by D. R. from noon of the 15th, was Lat. 9° 30′ S.; Long. 79° 20′ east.

Abridged Extract from the Log of the Barque POLLY, JOHN BINNIE *Master, from Greenock to Bombay.—Civil Time. From* T. SMITH, *Esq. Bombay.*

On the 14th January 1848—P. M. Steady breeze from S. E., all sail set, increasing towards midnight.

15th Jan.—A. M. a large black cloud in the N. E. quarter with strong *chain* lightning coming out of it.* Bar. falling a little. 4 A. M. strong breeze dark gloomy weather. Bar. stationary from 4 A. M. to 7 A. M. when it commenced falling gradually to noon when making preparations for bad weather. At noon strong gale S. E. with rain. Ship running under double-reefed topsails and courses Lat. by Acct. 10° 25′ S.; Long. 79° 00′ East P. M. increasing gale and heavy sea from the S. S. E. Ship running 7 knots to the N. b. E. wind S. S. E. 4.30 P. M. weather looking very wild "atmosphere nearly as black as night." Barometer falling rapidly. 5 P. M. broached to.† Barometer now fell 3 tenths in one quarter of an hour; lying to under bare poles blowing a hurricane, lost foretopmast, ship on her beam ends. During the night appearance of the weather terrific. Barometer at midnight was at the lowest, being then at 27.5 after which began to rise.

16th Jan.—1 A. M. wind N. E. gusts of wind frightful, impossible to hear each other speak to 8 A. M., after which it began to moderate. Noon still blowing a heavy gale. No observation. P. M. moderating. No D. R. is given and no observation was obtained till the 19th when the Lat. was 10° ′22 S.; Long. 75° 10′; E. "shewing that the ship had drifted nearly 4°. West during the hurricane," as she had nothing but calms from that time.

* This was probably the disk of the Cyclone. I do not know what kind of lightning is meant by *chain* lightning.

† Now in about Lat. 9° 46′ S.; Long. 79° 8′ East.

Abridged Extract from the Log of the Ship STRABANE, *Capt.* ANDERSON, *from Glasgow to Bombay.—Civil Time. From* T. SMITH, *Esq. Bombay.*

15*th Jan.*—A. M. light unsteady breezes E. S. E. throughout with sultry weather and a heavy swell from the eastward. Noon Lat. 13° 57′ S.; Long. 73° 11′ east; Bar. 29.70; Simp. 29.23; Ther. 83 to 96°. P. M. breeze freshened from E. S. E. with at first a clear sky and a heavy swell from the eastward. The sky completely covered with the long white streaks commonly called mares' tails, with diminution of the wind. "The Simpiesometer these three days past fell considerably during the day and rose during the night, but it was much lower than it would have been under ordinary circumstances from the light weather we had. This, with the heavy, swell convinced me that it must have been blowing hard not far off, and I mentioned on the 17th, when the gale moderated, to my officers that I did not think we had the worst of it."

16*th Jan.*—A. M. wind E. S. E. fresh breeze veering southerly to S. S. E. and P. M. to S. S. W.* Dull gloomy sky and rain at times. A confused heavy swell from several directions with heavy rain squalls. Noon Lat. 11° 7′ S.; Long. 73° 10′ east; Bar. 29.50; Simp. 28.95; Ther. 83° to 85°. P. M. wind S. S. W., West and N. W. frequent squalls from S. S. E. and rain. 6, heavy rain and squalls from South with "*occasionally a few tremendous rollers from the eastward besides a heavy swell from the southward;*" making preparations for bad weather. At 10 P. M. freshening fast. Midnight a severe gale and rain with fearful squalls. Ship on the port tack standing to the north eastward. Bar. 29.40; Simp. 29.07.

17*th Jan.*—Furious gale from N. W. with very severe squalls and rain. Noon moderating, wind about North, made a little sail. Lat. 9.20′ S.; Long. 74° 17′ east; Bar. 29.55; Simp. 29.00. Ther. 82° to 84°. P. M. to midnight moderating. Bar. at midnight 29.61; Simp 29.26.

The Barque NEW EXPRESS, *Capt.* BARRETT, *from England to Ceylon.*

Was on the 15*th January*, at noon in Lat. 10° 14′ S.; Long. Chr. 79° 2′ east; Bar 29.85 with a strong breeze from S. E. b. E. and a very heavy sea. P. M. S. E. and at 10 P. M. East, heavy squalls; steering to the N. E. b. N. and N. E.

16*th Jan.*—Wind east, very heavy sea, and pitching bows under. Noon Lat. 13° 18′ S. Long. Chr. 79° 45′ East; Bar. 29.85· P. M. wind East, heavy confused sea; steering to N. N. E and N. b. E.

17*th Jan.*—1 A. M. wind E. N. E. 4 A. M. moderate. Lat. 12° 18′ S.; Long. 79° 45′; Bar. 29.90.

* This extract though most carefully made does not give the exact wind at noon We must therefore take it to have been south, and the lowest depression of the Bar. was after this time, when the ship was crossing in front of the Cyclone and he wind was increasing in strength and veering rapidly as she did so.

Tabular view of the winds and weather at Noon on the 14th, 15th and 16th January, 1848, Sir HOWARD DOUGLAS' *Cyclones.*

Date.	*Name of Ship or Station.*	*Lat. S.*	*Long. East.*	*Winds and Weather.*	*Bar.*	*Simp.*	*Ther.*	*Remarks.*
1848. 14th Jan. Noon.	Isabella Blyth.	9°.22′	88°.39′	Light N. E. and E. S. E.	29.88	29.75	84°	A heavy swell from the westward.
	Sir H. Douglas.	14°.18′	80°.49′	Strong gales and squally E. b. S. and E. S. E.	29.54		78°	Ship running to the N. b. E. 149′ in the 24 h. Midnight double reefs.
15th	Isabella Blyth.	10°.59′	87°.25′	Gloomy showery weather settling at 8 P. M. to the S. E. trade.	29.91	29.81	82°	A confused heavy swell from the westward meeting a lesser swell from the east. Suppose it to have been blowing hard to the westward.
					8 A. M. 29.53			
	Sir H. Douglas.	11°.30′	80°.24′	Strong gales and heavy squalls P. M. wind S. E.	Noon		75°	Ship running to the N. b. W. and N. N. W. 17′ since noon of 14th. Midnight wind about east.
		Midnight			29.41		75°	
		10°.10′	79°.49′		8 P. M. 29.14		73°	
	Admiral Moorsom.	11°.2′	About 79°.0′	S. E. squally and threatening. 8 P. M. veering from S. S. E. to S. S. W. at midnight.				Gale increasing fast throughout.
	Polly.	10°.25′	19°.00′	Increasing gale ; noon S. E. P. M. S. S. E.	Midnt. 27.50			A. M. a large black cloud in the N. E. with chain lightning ; sea from S. S E. ship running to the N. b. E. 5 P. M. broached to. Midnight hurricane, lost fore topmast.
								Broached to, in abt. Lat. 9°. 46′ S. : Long. 79° 8′ east.

Sir HOWARD DOUGLAS' *Cyclone.*

Date	*Name of Ship or Station.*	*Lat. S.*	*Long. East.*	*Winds and Weather.*	*Bar.*	*Simp.*	*Ther.*	*Remarks.*
1848.								
15th Jan.	Strabane.	13° 57′	73° 11′	Breeze fresh from E. S. E. and a heavy swell from the Eastward.	29.70	29.23	83.86°	Ship running to the northward,
	New Express.	15° 14′	79° 2′	Strong breeze S. E. b. E. and heavy sea. P. M. S. E. midnight East.	29.85			Ship standing to the N. E. b. N. and N. East.
1850.								
16th Jan.	Sir Howard Douglas.			Uncertain from, the distress of the vessel said to be from E. b. N, to N. N. E.; then by the west and N. W. to southward.	29.50		72°	Ship running to the N. N. W. 1 A. M. overset and cargo of coals shifted, lost mizen-mast, rudder-head, &c. Log uncertain, the Captain having been hurt.
	Admiral Moorsom.	About 9° 30′	79° 20′	Midnight very black and heavy rain, Wind S. W, to West. N. N. W. N. W. N. N. W., North, and at noon N. E.				Position in the height of the hurricane from 3 to 5 A. M. Evening much abated. Sprung bowsprit, lost foretopmast, &c. Fall of the Barometer very sudden.
	Strabane.	11° 7′	73° 10′	Dull gloomy wind veering to S. S. E. P. M. to S. S. West and N. W. Midnight severe gale and rain.	29.50	28.95	83.86°	Heavy confused swell from several directions. Making preparations for bad weather *Note.*—On 17th, a very severe gale from N. W. Moderating at noon. Lat. 9° 20′ N.; Long. 74° 17′ east; Bar. 29.55.
	New Express.	13° 18′	79° 45′	East wind and heavy sea.	29.85			P. M. heavy confused sea.

PART II.

The Jumna's Cyclone.

Abridged Extract from the Log and Admiralty Report of H. M. Brig Jumna, *Lieut.* Rodney, *Commander, from Bombay to England.*

I have received from Capt. Fitzgerald, H. M. S. *Vernon*, then senior officer at Bombay, from Lt. Rodney himself, and from friends, copies of public and private reports and accounts of the dismasting of this fine new Brig, which was on her way from the dock-yard at Bombay to England, but they are all singularly deficient in one respect, viz. that they do not give the vessel's run from the 22nd, though one report actually gives every thing in the Logs of 22nd to 24th April, *but* the distances and positions at noon! An omission no doubt of the copyist's but a very vexatious one to us. The position of the vessel at noon 23rd, (and thence at 11 P. M. when she was dismasted) is however given by Lt. Rodney, but for comparisons with other ships the want of the exact positions, from fine weather to fine weather again, is always requisite, as this serves moreover to fix the limits of the Cyclone influence. The italics in the following abridgment are mine.

From Bombay to Lat. 8° 59′ S.; Long. 85° 34′ east, which position H. M. Brig reached in ten days from Bombay and at 3 A. M. of the 23rd April 1848, the *Jumna* had the usual fair winds, with heavy squalls thunder and lightning, especially at night. At 3 A. M. it came on to blow from N. West; and at 5' veered to West; at 6 A. M. to W. N. W.; and at ½ past 8 (force 10) to noon N. N. W.* The Brig in this interval, 3 A. M. to noon 23rd. had run from 9 to 12 knots to the South and S. S. W., mostly S. S. W.; and is placed at noon 23rd April, by Lt. Rodney in Lat. 10° 28′ south; Long. 85° 0′ east. The Barometer having fallen from 29.57 to 29.33. The Ther. 82° and 82½°.

At 1 P. M. wind is marked N.b. W. (force 10); at 3, N. N. W.; (force 9) and at 4, calm; by which time the Brig had reached Lat. 11° 08′ S; Long. 84° 43′ east by her Log. the Bar. being now at 29.21 and falling; Ther. 82°; great numbers of birds apparently much terrified, hanging about the ship, alighting on the deck and rigging, and allowing themselves to be caught without resistance. Blue sky appeared around the horizon with the exception of the N. E. where a

* There is a discrepancy here which should be noted, and is perhaps again an error of the copyist. Lieut. Rodney's Admiralty Report says, "a gale sprung up at 3 A. M. from North veering at times to N. N. W." while his own copy of tho Log and two others which I have, give the winds as above stated. All three cannot be wrong we should suppose? I therefore take them as correct.

very heavy bank of clouds hung, *but there was also an indescribable feeling in the atmosphere.*

At half-past 4, the wind is marked as W. S. W. (force 6). At half-past 6, West; at 7, S. W. and W. b. S. (force 10), and S. W. again at 8 P. M. to midnight; force being marked from 10 to 12, but it is said to have been higher than the figures can express, the run at 11^h. and 12^h.; and to 4 A. M. of the 24th is marked at 14 knots. The Bar. at 7 P. M. is at 29.19; at 8 P. M. 29.18; at 9h. 29.16; at 10^h. 29.18; at 11^h. 29.16; and at midnight 29.16: Ther. 81° and 82° throughout. The Brig was hove to at 5.30; but at 8.40 was obliged to bear up, as she heeled over too much to be safe. She was then steered to the N. E. but at 10.45 broached to and went over (about in Lat. 11° 31′ S.; Long. 84° 54′ east) and the mainmast was cut away to right her. After this she continued running, under the foremast only, at the rate of 14 or 15 knots till 4 A. M. when the gale moderated very rapidly, the vessel being by noon 24th April in Lat. 10° 14′; Long. 85° 50′ by Lt. R. The Bar. rose from 29.16 at midnight to 29.42, at noon.*

Abridged Log of the Ship SULTANY, *Capt.* H. H. HANDLEY, *from Mauritius to Calcutta.—Reduced to Civil Time.*

21*st April*, 1848.—Two days previous to this date the wind was varying from North to N. E. with a threatening appearance and a heavy swell from N. N. E. with the Barometer gradually falling. Noon in Lat. 8° 15′ S.; Long. 86° 22′ E.; Bar. 29.75. Reducing sail and preparing for bad weather. Wind North; P. M., N. N. E. at 4: N. E. at 6; and N. N. E. at 10 P. M. to midnight; ship running $6\frac{1}{2}$ knots to the W. S. W. At 10 P. M. under a close reefed foretopsail, gale blowing furiously.

22*nd April*, 7 A. M. Bar. 29.64. Securing everything for a gale. Noon Lat. 9 24′ S.; Long. 84° 35′ East; Bar. 29.63; Ther. 83°. Wind N. E. from 4 A. M.; P. M. N. E. increasing; and at 3 P. M. hove to under close reefed main topsail. Bar. at 2h. 30′ P. M. 29.35; 4h. P. M. 29.12; at 5h. 29.8; 6h. 29.10; 7h. 29.12; to P. M. 29.15; 6 P. M. wind N. E. to 9h. P. M. when North with furious squalls: at midnight N. E.

23*rd April*, A. M. Blowing a hurricane from N. E. ship lying with her lee gunwale in the water, towards noon wind all round the compass, with a dreadful sea and thick dense atmosphere. Noon Bar. 29.16. No observations. Lat. by Acct. 9° 32′ S.; Long. 83° 37′ east; Ther. 83°. P. M. wind marked S. W. Set close reefed mizen topsail and reefed foresail and ran 10 miles north; but at

* A complete Log is given in the Remarks explaining the singular track of this Cyclone.

3 P. M. the gale increasing hove to again. Bar. 29.12 at 6 P. M.; at 7h. 29.15; at 8h. 29.20; 11 P. M. wind West, impossible to blow harder; 11h. 29. 26; midnight Bar. 29.28. From 8 to 10 P. M. vivid lightning with a remarkable red appearance to the S. E. throughout the night.

24th April.—Gale abating. 3 A. M. Bar. 29.27. Wind West at noon, found 4 feet water in the well, sea going down. Noon Lat. Obs. 9° 21′ N.; Long. 85° 8′ East by Indiff. observations; Bar. 29.64; Ther. 83° ½. After which fine weather. Ship by Chr. on this day was 29′ east of Acct. estimating her drift at 3′ per hour throughout.

From the Mauricien of May 24th, 1848, we have the following notices:—

The bark *Samarang* experienced on the 21st April, in Lat. 9° 44′ S.; and Long. 72° E.; a hurricane that lasted 40 hours, wind from N. E. to S. W. Barometer fell to 28.20, bulwarks carried away, sails split, etc.

The *Mary Stoddart* experienced on the 22nd and 23rd April, in Lat. 10° 30′ S.; and Long. 86° 50′ E., a severe hurricane, wind from N. E. to S. W. Barometer 29.10, bulwarks carried away, stern dead lights stove in, and washed away the starboard cabin, rudder damaged; put into this port for repairs.

On the 23rd April, in Lat. 9° 18′ S.; and Long. 84° E.; the *Pemberton* experienced a hurricane; wind from N. N. W. to West and W. S. W., vessel sprung a leak and lost the head of her rudder, and caused her to put in for repairs; threw overboard about 1000 bales cotton.

On the 23rd of April, the *Brig Deborah* being in Lat. 9° 19′ South; Long. 82° 50′ East, experienced a severe hurricane from N. E. to S. W., which laid the ship on her beam-ends for some time, the sea very heavy and the ship straining much. It commenced at 6 o'clock A. M. and blew severely till half past 10 A. M.—*Le Mauricien, May* 24th, 1848.

The following is from some imperfect notes by a Civilian passenger, Mr. Meldrum, *Professor in the College at Bombay, on board the ship* Pemberton *from Bombay to the Mauritius; which have been kindly forwarded by Dr.* Buist *from that gentleman.*

This vessel was without either Barometer or Simpiesometer; the Barometer having been broken "the Captain did not think it at all important to have it repaired!" And it will be seen that the ship's position is recorded on two days only, once at noon and once near the centre of the Cyclone, which last is however very important.

Thursday, 20th April, 1848.—Wind to-day from N., sky still dark and gloomy with heavy cumuli; Lat. 6° 31′ 10″ S.; Long. 83° E.; a heavy squall about 6 o'clock.

Friday, 21*st April.*—Sky lowering, wind shifting about; but it is almost calm, very gloomy, no observation; in the evening dead calm, soon after cleared up a little towards S., and a light breeze sprung up from S. W.; about midnight wind increased and blew pretty hard; flocks of sea birds.

Saturday, 22*nd April.*—Strong gale from N. by E., sky pretty clear towards horizon, wind shifting from N. by E. towards S. and S. by W. with great violence, rudder damaged by a heavy sea; sea raging, much rain; Lat. 9° 41′ 17″ S.; Long 83° 55′ east; about midnight weather moderated but sea ran tremendously high.

Sunday, 23*rd April.*—At 4 A. M. wind got up again and blew from S. by W. with greater violence. By noon, it was at its height, bulwarks driven in (the top gallant masts had been housed) scrambled on deck, clouds tattered, meeting with the spray, lower strata appear to move in a direction contrary to the upper, perhaps owing to their difference in velocity. After some hours the wind began gradually to abate and shift towards S. and S. E. By 6 o'clock it was pretty quiet, sea running very high.

Abridged Log of the Ship SAMARANG, *Capt.* BUCKLE, *from Calcutta to the Mauritius.—Reduced to Civil Time.*

21*st April.*—At noon in Lat. 8° 76′ S.; Long. 86° 14′ east; wind N. E. b. N. Increasing breeze and squally; course S. W. 8 knots. Bar. 29.79; Ther. 83°. P. M. wind N. E. b. E. course as before to midnight. At 10 P. M. moderating but Barometer (which is registered every hour) falling from 29.79: at 1 P. M. to 29.68 at midnight, when squally with rain.

22*nd April.*—A. M. increasing with hard squalls; wind N. E. b. E., course as before; 7 A. M. 8 knots to the S. W. *Day light more moderate again.* At 10 A. M. increasing to a gale. Preparing for bad weather. Bar. falling from 29.67 at 1 A. M. to 29.52 at noon, when wind about E. N. E. a gale. No observations Lat. Act. 10° 27′ S.; Long. 83° 34′ East. Fresh gale and high sea. P. M. wind E. b. N. Gale increasing, hove to at 1 P. M. 6 P. M. wind E. N. E.; 10 P. M. East; at 8, increasing to a hurricane. Bar. falling from 29.52 at 1 P. M. to 29.39 at 6 P. M.; rising to 29.45 at 8h. and falling again to 29.39 to midnight.

23*rd April.*—A. M. hurricane still increasing, wind S. E., sea tremendous. 3 A. M. blowing with terrible fury, hove 300 bags of rice overboard. At 4, ship easier but hurricane still raging. All hands at the pumps for many hours. At 8, wind South, squalls not so heavy. Noon hurricane more moderate. Bar. from 29.39 at 1 A. M. to 29.50 at noon; Ther. 76°; Lat. Acct. 10° 32′ S.; Long. 82° 10′ east. Wind South decreasing; 3 P. M. S. S. W. 8 P. M. West. Bar. from 29.48 at 1 P. M. to 29.62 at midnight with the gale constantly decreasing.

24*th April.*—A. M. wind S. S. W.; at 6 A. M. S. b. W.; Bar. from 29.62 at 1 A. M. to 29.72 at noon, when a strong breeze at S. b. W. with a very high

sea. Lat. Obs. 10° 37′ S.; Long. 82° 22′ east. Course and distance S. 59° W. 269 miles in 2 days by Chr. giving 11′ of Southing and 93′ of Easting for the storm current and storm wave.

Abstract from the Log of the Barque BRAEMAR, *Capt.* TETHERINGTON, *from Calcutta to Mauritius.—Reduced to Civil Time.*

21*st April*, 1848.—At noon Lat. 6° 43′ S.; Long. 88° 10′ east; Bar. 29.77; Ther. 84°. P. M. wind N. E. to East, steering to the S. S. W. 5 to 6 knots per hour. Cloudy with a confused sea on.

22*nd April.*—A. M. fresh gales N. N. E. with a high rolling sea; towards Noon wind N. E. b. E., sea increasing. Course always S. S. W. Lat. 9° 01′ S. Long. 86° 46′ east; Bar. 29.74; Ther. 82°. P. M. wind N. E. Fresh gales drizzling rain and a high rolling sea. 8, increasing "*with heavy seas from the N. West S. E. and S. W.*" Close reefed; to 6 P. M. steering S. S. W. and afterwards South. Wind N. E., Bar. 29.54 at 4 P. M. and 29.58 at midnight.

23*rd April.*—A. M. ran 48′ south and hove to in Lat. 11° 9′ S.; Long. 86° 28′ east by Acct.; wind N. E. (apparently) to 10 A. M. when it is marked E. N. E. 8 A. M. "gale suddenly increasing." Noon a high turbulent sea, Lat. Acct. 11° 7′ S.; Long. Acct. 85° 54′ E.; Bar. 29.45. Vessel lying S. S. E. drift marked 1.4 per hour with wind marked E. N. E. 2 P. M. wind E. N. E. Bar. 29.45. 8 P. M. 29.35; wind *veered* to S. E. Midnight a perfect hurricane, with a terrific sea on, making a clear breach over all. Bar. midnight 29.25.

24*th April.*—2 A. M. hurricane veered to the southward (it is *marked* South at midnight). And at 4, S. S. W. still increasing. At 3, vessel on her beam ends; Bar. 29.16; and being in danger of foundering cut away the mainmast; 4.30 P. M. Bar. began to rise; lowest point being at 4 A. M. 29.15. Forenoon hurricane slightly abating, with a tremendous sea from N. West; N. East; S. E. and S. W. Bar. at noon rising; Lat. 11° 27′ S.; Long. by Acct. 85° 68′ east. P. M. to midnight wind S. S. W. decreasing to strong breezes.

25*th April.*—To noon moderating from S. S. W. making sail. Lat. Obs. 11° 9′ S.; Long. 85° 02′ east; Bar. 29° 70′; Ther. 84° 00′.

Abridged Log of the Ship LADY SALE, *Capt.* CASTOR, *from Calcutta to the Mauritius.—Reduced to Civil Time.*

20*th April*, 1848.—Steady breeze at N. W. and North to midnight.

21*st April.*—Wind North, strong breeze and squally, increasing to noon with a heavy sea from the S. E. Noon Lat. Obs. 8° 16′ S.; Long. 86° 35′ East. Course and distance from noon 21st S. W. $\frac{3}{4}$ S. 147′. P. M. wind North at 6 P. M. N. E. 3.30, a heavy squall. Bar. falling to 29.40; from 29.70; (in the

fine weather of the 20th it is supposed, as the exact time is not given). At 11, hard squalls and a high sea Bar. 29.35.

22*nd April.*—Preparing for bad weather. Noon hard gales and high sea, wind veering to the Eastward. Lat. Acct. 9° 10′ S.; Long. about P. M. severe gales E. N. E. threatening weather and dismal appearance. At 4, wind East; at 6, E. S. E.; at 10, S. E. Close reefing and battening down hatches and making all preparations for a hurricane. 4 P. M. Bar. 29.20. Gale increasing with violent gusts.

23*rd April.*—At 2 A. M. hove to; Bar. 29.18; at 5, gale increasing to a hurricane and veering to the Southward. 5.30 ship on her beam ends with the lee rail buried in the water. Cut away the mizen mast and quarter boats and hove some cargo overboard. Wind veering fast to S. W. but blowing with indescribable violence. Bar. 29.15. At 4.30 A. M. Bar. 29.32; but abating; noon Bar. 29.40. P. M. strong breezes S. b. W. and South, and S. b. E. at midnight.

24*th April.*—Fine. Noon Lat. Obs. 10° 44′ S.; Long. 81° 24′ east; wind S. b. E.

In addition to his Log, Capt. Castor has farther obliged me with the following notes:—

From the 20th April to the morning preceding the hurricane the winds prevailed mostly from N. W. to N. with a long swell rolling to the Southward from the N. E. with hard squalls, accompanied with heavy showers of rain. The wind gradually veered from N. N. E. to E. and S. E. ending with indescribable fury at S. to S. W. The moon was encircled with an immense halo which had the appearance of a dense cloud for three successive days before the Cyclone; the light of the moon, and stars was uncommonly brilliant during the existence of the halo, a great oppression in the atmosphere was felt. Sky at night almost cloudless, the wind never *shifted* in this hurricane, but veered gradually, the sea ran high, and rain poured down in torrents,accompanied with violent gusts every fifteen to twenty minutes. Bar. two days previous to the hurricane stood at 29.70, and fell gradually with the state of the weather to 29.15; and remained at that range during the height of the storm. It began to rise an hour or two before the worse part abated. After the hurricane the winds prevailed for two days from the southward and westward, light and variable, with a long swell from the S. E.

N. B.—The wind was stronger than in the hurricane experienced on the 16th of November, 1839, when Coringa was inundated, but the sea less. I remember the wind in that storm shifted from four to six points, but in this it veered gradually.

Extract from a Tabular Statement of the Voyage of the H. C. Pilot Brig SALWEEN, *from Port Leschenault to Calcutta.—Nautical Time.*

21*st April*, 1848.—Made 67 miles to the W., N. W. winds variable N. E. to N. N. W. Lat at noon 6° 20′ S.; Long. 86° 6′ east; Bar. 29.30 to 29.60; Ther. 81°. Light winds, squally wet weather, thunder, lightning and rain, and threatening appearance with a N. N. W. sea.

22*nd April* —Made 19′ to the N. W. b. W. ½ W. only; winds variable from N. E. to N. N. W. and Northerly. Lat. at noon 6° 20′ S; Long. 85° east; Bar. 29.60 to 29.75; Ther. 83°. Squally wet dirty weather with a bad threatening appearance! *Am sure we are not far from some very severe weather from the very threatening appearances of some days past.* Sent top gallant masts on deck and made all due preparations for meeting a hurricane. Spoke H. M. Brig *Jumna*, 9 days from Bombay, running to the southward.*

Abridged Log of the Ship FUTTLE ROZACK, *Capt.* RUNDLE, *from Calcutta to the Mauritius.—Civil Time.*

This able Log affords a valuable and instructive example of a ship being caught in front of a Cyclone in the Southern Hemisphere, and though bound to the W. S. Westward running to the N. Westward to allow the centre to pass. The passages in italics are so marked by myself, and I may add that the *Futtle Rozack* is a heavy sailing ship, and was deeply laden with rice and coolies.

From the 17*th April*, when in Lat. 5° 53′ S.; Long. 86° 4′ East at noon to the —

19*th of April.*—At noon in Lat. 7° 38′ S.; Long. 85° 36′ east; the ship had light variable winds all round the compass with calms and squally appearances at times; the Bar. being on 17th at noon at 29.71; Simp. at 29.27 and Ther. 84°; and on the 19th Bar. 29.60; Simp. 29.27; Ther. 82°. On the 18th, Capt. Rundle remarks —"Noon light breeze and cloudy, Bar. and Simp. very low and have been gradually going down this last four days. Preparing for bad weather." And P. M., again, that "the weather is suspicious, or rather that the continued fall of the Bar. and Simp. is so, but the *weather* altogether does not appear to indicate the approach of any great change more than we might expect on the verge of the S. E. trade, although this heavy S. E. swell rolling up is suspicious."

* I regret much that this Register is in Nautical Time and that there is no hour affixed to this notice.

On the 19th April.—From A. M. to noon winds variable from N. N. E.; North-West; W. S. W.; S. W. b. W. and S. W. ship running to the S. S. W., S. W. b. S; South; S. S. E. and S. E. from 2 to 7 knots; squally unsettled weather and S. E. swell. Noon moderate. Light S. S. W. breeze, heavy sea with dark ponderous masses of clouds rolling up from the southward to the zenith and then gradually disappearing. Lat. Indiff. Obs. 7.38 S.; Long. 85° 36′ East; Bar. 29.60; Simp. 29.27; Ther. 82°. P. M. S. E. airs and a stationary bank of dark Nimbi to the S. Eastward. Clouds A. M. Cumuli, cumulo-strata, and dense packed Nimbi. To midnight wind increasing and decreasing from the S. E. every 3 or 4 hours.

20th April.—A. M. winds East to N. E. and E. N. E. at 10 A. M., and moderate. Ship making from 7 to 4.4 knots to the S. S. W. Noon Lat. Acct. 9° 14′ S.; Long. 85° 14′ East; Bar. 29.52; Simp. 29.20; Ther. 83°. P. M. wind N. E.; E. N. E. and East at 6 P. M. when again S. East, E. N. E. and N. N. E. to midnight. At 4, clear sky to the North, and dark and heavy to the Southward, midnight fresh N. N. E. breeze and very heavy rain clouds. P. M. dense strata.

21st April.—A. M. strong squalls N. E. veering to East and to E. S. E.; at 4 A. M. with heavy rain; daylight strong gales and heavy sea. Weather like the commencement of a strong trade, but Bar. and Simp. too low to feel satisfied with appearances. Noon fresh gales S. E. (from 10 A. M.) Lat. Obs. 10° 23′ S.; Long. Chr. 84.5; Bar. 29.55; Simp. 29.20; Ther. 83°. Clouds A. M. Cirro cumuli, leaden stratus to S. E. P. M. threatening weather to the Southward, wind S. E.; at 2, S. S. E. veering to E. b. S.; at midnight marked S. E. again; at 5, strong gales, and at 8, heavy gusts at intervals with a frightful turbulent swell and a confused sea breaking heavily all round "as if the ship was surrounded by coral reefs." *From 9 to midnight more moderate.* Bar. 29.54; Simp. 29.18; Ther. 82°. Clouds P. M. leaden coloured.

22nd April.—A. M. wind E. S. E. to S. E. 10 A. M. S. E. b. S. At noon S. E. 2 A. M. dense threatening arched banks, continually rising from S. E. with much rain and tremendous squalls. 9, squalls continue with frequent lulls. Bar. at 29.48 and continuing to fall. *Feeling convinced that if we stand any farther to the Southward (S. W.) we shall get involved, and that the storm is tearing down on us from the Eastward.* At 10, stood away N. W. to get clear of its influence. At 11, very high sea at intervals, strong squalls, wind veering to the Southward. (S. E. b. S.) Noon the same with a gloomy leaden appearance; Lat. D.R. 11° 38′ S.; Long. 82° 49′ East; Bar. 29.50; Simp. 29.21; Ther. 82°. Clouds A. M. heavy low leaden strata. Ship now running 6 knots to the N. W. P. M. more moderate; under close reefed fore and main topsails; at 2. tremendous turbulent sea rising in heaps. Wind S. S. E. at 1; S. b. E. at 3; S. S. E. at 5 P. M.; after which alternating from S. ½ E. to S. E. to mid-

night. At 3 P. M. same gales. Sun inclined to break through the clouds. At 6, squalls less frequent. A red lurid appearance to the W. N. W. Bar. from 29.49 to 29.52; at 9 P. M. Simp. 29.19 to 29.93. Ther. 81°. Midnight thick weather and rain. Clouds, heavy stratus. Stationary cirrus over all.

23*rd April.*—A. M. less wind and sea except in the squalls, with occasional rain. Wind S. b. E. to S. E to 5 A. M. when South to noon. Bar. 29.49 to 29.54; Simp. 29.16 to 29.20; Ther. 82°; 2.20 A. M. moon and stars shining brightly. Ship running to the N. W. till 10 A. M. when North till noon. Daylight more sea; at 6 A. M. fine and clear over head, moon shining brightly. Lofty wavy cirrus from N. E. to S. W. Gloomy appearance towards the horizon from North to Eastward and S. Westward,*tremendous high curling seas at intervals.** At 8, wind South; lofty cirri and dark cumulo-strata with rounded edges rolling up from S. S. E. Less wind, Bar. rising, bore away to North at 10 A. M. Noon moderating from over head, but threatening spherical cumulo-strata rolling up from Southward *with tremendous overgrown seas at intervals.* Wind moderating. Lat. Obs. 9° 45′ S.; Long. 80° 28′ East; Bar. 29.54; Simp. 29.20; Ther. 82°. P. M. kept a N. E. course; at 2 steady gales South t° S. b. E. thick and threatening appearance to Southward *and tremendous seas at intervals.* At 4, Cyclone seeming to have a slow progression to the Westward; resolved instead of steering to get to the Eastward of it (behind it) to run to the Westward, and should we find it coming up again can easily get out of its influence by running to the Northward. Stood to the Westward at 9 P. M. 10, light squalls with rain at intervals from arched Nimbi rising from the South and rapidly approaching the zenith; stars visible but sickly appearance. Wind South to S. b. E. throughout. Bar. P. M. 29.50 to 29.60; Simp. 29.18 to 29.24; Ther. 82°. Clouds; packed dark cumuli to S. East: Stationary cirri over all.

24*th April.*—Weather gradually becoming fine. Winds moderate at South to S. b. E. to noon, when Lat. 9° 39′ S.; Long. 78° 37′ East; Bar. 29.60; Simp. 29.22; Ther. 83°. At 4 A. M. ponderous clouds to S. East, scud flying with great rapidity to the Northward.

The following extract is from the Calcutta *Englishman.* I have been unable to obtain a copy of the *Hardwicke's Log.*

A friend has sent us the following extract from the letter of a passenger on board the *Earl of Hardwicke*:—

* These high curling seas at intervals appear well worthy of consideration, I have often met with notices of them. They are no doubt the *resultant* waves of the distant Cyclone forces.

"From the 18th March, 1848, the day on which the *Hardwicke* left the Sand Heads, until the 19th April, we had hot sultry calm weather, but upon the 22d April, 1848, in Lat. 12° South; Long. 83° East; we had a fearful hurricane, which lasted 3 days. It blew from the S. E. and, under Providence, I consider that Mr. Piddington's instructions saved us from being foundered. The Captain, Lewis Browne, had been studying his book a whole month before the hurricane commenced, so that, when it did come, he was prepared, and being in the proper spot he lay to, and so the storm passed us. I have been to sea pretty often, but I never saw anything so awful as the sea during the three days that we lay to. I forgot to get the extract from the Log; but get it you must, as it will be a good link in the chain of this invaluable branch of knowledge."

In a letter from Capt. Faucon, American Brig *Frolic*, he mentions that—

The *Ormelie* of Glasgow, from Calcutta to Liverpool, reports, that on Sunday last, April 23rd, 1848, he was in 8° S.; and 89° East; had a heavy gale from the Westward; lost top gallant masts, jibboom, &c. and sprung his bowsprit.

Tabular view of the Winds and Weather from the 21st to the 23rd April, 1848.

THE JUMNA'S CYCLONE.

Date.	*Name of Ship or Station.*	*Lat. S.*	*Long. East.*	*Winds and Weather.*	*Bar.*		*Simp.*	*Ther.*	*Remarks.*
1848. 21st April.	Braemar.	6° 43′	88° 10′	Cloudy and confused sea. Wind N. E. to East.		29.77	..	84	Vessel steering to S. S. W.
	Sultany.	8° 15′	86° 22′	Variable winds from North at Noon, to N. E. and N. N. E., P. M.		29.75	..	..	Redueing sail and preparing for bad weather. Threatening appearanee, and heavy swell from N. N. E. ; 10 P. M. under close reefed fore topsail.
	Samarang.	8° 16′	86° 14′	Inereasing breeze N. E. and squally. P. M. N. E. b. E. squally.	Mid.	29.79 29.68	..	83°	Vessel running S. W. 8 knots. Ten P. M. moderating, but Bar. always falling.
	Lady Sale.	8° 16′	86° 35′	Noon, North, strong breeze. P. M. North. 6 P. M. N. E. 11, hard squalls.	P. M. Mid.	29.40 29.35	..	..	Noon heavy sea from S. E. Ship running to the S. W.
	Futtle Rozack.	10° 23	84° 5′	A. M. strong squalls N. E. to East and E. S. E. Noon S. E. fresh gales. P. M. threatening to the South, wind S. E. and S. S. E.; E. b. S. and S. E. at midnight.	Mid.	29.55 29.54	29.20 29.18	83° 82	By 5 P. M. strong gales with heavy gusts, with a turbulent swell and confused sea. 9 to Midnight, more moderate.

Date.	Name of Ship or Station.	Lat. S.	Long. East.	Winds and Weather.	Bar.	Simp.	Ther.	Remarks.
1848. 22nd April.	Braemar.	9°.01′	86°.46′	N. E. b. E. P. M. N. E. fresh gales, drizzling rain.	29.74 4 P. M. 29.54 Mid. 29.58		82°	Ship running to the S. S. W. and South. High rolling and confused sea.
	Sultany.	9°.24′	84°.35′	N. E. increasing. 9 P. M. North, Midnight N. E. furious squalls.	7 A. M. 29.64 Noon 29.63 2 P. M. —.35 4 ——— .12		83°	Increasing gale throughout. 3 P. M. hove too.
	Samarang.	10°.27′	83°.34′	A. M. N. E. b. E. hard squalls. At 10 a Gale.	1 A. M. 29.67 Noon —.52			Ship running 7 and 8 knots to the S. W.
	Lady Sale.	9°.10	..	Noon hard gales and high sea, Wind Veering to Eastward. P. M. E. N. E. 4 East; E. S. E 10 S. E. increasing.	4 P. M. 29.20			Preparing for bad weather P. M. threatening.
	Futtle Rozack.	11°.38	82°.49′	A. M. E. S. E. to S. E.; 10 S. E. b. S. Noon S. E. b. S. P. M. more moderate. Wind S. S. E. to S. ½.; E. and S. E.	9 A. M. 29.48 Noon 29.50 P. M. 29.49 29.52	29.21 29.19 28.93	82°	2. A. M. Dense threatening clouds. 9 heavy squalls and frequent lulls. At 10 stood N. W. to clear the Cyclone. Running 6 knots to the N. W. Midnight thick weather and rain.

Date.	*Name of Ship or Station.*	*Lat. S.*	*Long. East.*	*Winds and Weather.*	*Bar.*	*Simp.*	*Ther.*	*Remarks.*
1848. 23rd April.	Braemar.	11°7′	85°.54′	To 10 A. M. N. E., when E. N. E.; 8 increasing suddenly. P. M. E. N. E. 3 P. M. Veered to S. E. Midnight hurricane South.	29.45 29.45 8 P. M. 29.35 Mid. 29.26			Ran 48′ South and hove to. Lying to, terrific sea. Head S. S. E.
	Sultany.	9°.32	83°.37′	A. M. Hurricane from N. E. Noon wind all round the compass. P. M. S. W. 11 P. M. West.	29.16 6 P. M. —.12 7 ———.15 8 ———.20 Mid. —.28			A dreadful sea and thick dense atmosphere from 8 to 10 P. M. Vivid lightning with a remarkable red appearance to the S. E. all night.
	Samarang.	10°.32′	82°.10′	Hurricane S E. 8 A. M. South. Noon more moderate P. M. South 3 P. M. S. S. W. 8 P. M. West.	1 A. M. 29.39 Noon 29.50 1 P. M. 29.48 Mid. 29.62	76°		Heaving cargo overboard and all hands at the Pumps.
	Lady Sale.			5 A. M. Increasing to a hurricane and veering to the South and S. W. Noon abating. P. M. Strong breeze. S. b. W. to S. b. E.	2 A. M. 29.18 5 30 29.15 4 A. M. 29 32 Noon 29.40			5. 30. Ship on her beam ends; cut away mizen mast and hove cargo overboard.

Date.	Name of Ship or Station.	Lat. S.	Long. East.	Winds and Weather.	Bar.		Simp.	Ther.	Remarks.
1848. 23rd April.	Futtle Rozack.	9.45	80.28	S. b. E. to S. E. at 5. South to Noon. Less wind 6 A. M. fine and clear 8 South, 2 Steady gales S. to S. b. E.		29.49	29.1°	82	Ship running to the N. W. till 10 A. M. and North till Noon.
						—.54	29.20	82	
					Noon	—.54	—20	82	P. M. Wind South to 4 P. M.; hauled to the Westward again.
					P. M.	—.61	- 24		
	H. M. S. Jumna			3 A. M. came on to	3.	29.57		82	From 3 A. M to Noon running
	at 3 A. M.	8.59	85.34	blow from N.W. 5 West,	Noon	29.33		82½	from 9 to 12 knots to the S. S. W.
	Noon	10.28	85. 0	7 W. 8 N. N.W. 1 P. M.	3.——	29.21		82	5.30 P. M. hove to. $10^h.45'$. Went
	3 P. M.	11.08	84.43	N. W. 3 N. N. W. and Calm to 4.15 P. M.; at Midnight hurricane from W. and S. W.	Midnight	29.16			over and cut away main mast.
1848. 24th April.	Braemar.	11.27	85.08′	2 A. M. South, 4 A. M. S. S. W. and increasing. Bar. rising at Noon.	3 A. M.	29.16			4 A. M. cut away mainmast. Forenoon; Hurricane slightly abating. Sea from all quarters. P. M. to mid. wind S. S. W. decreasing to strong breezes.
					4 ——	29.15			
	Sultany.	10.37	82.22′	A. M. Wind S. S. W. Noon strong breeze S.b.W	29.62 to 29.72 at Noon				
	Samarang.	10.37	82.22′	A. M. S. S. W. 6 A. M. S. b. W. Noon strong breeze S. b. W.	1 A. M.	29.62			Sea going down; 4 feet water in the hold. P. M. fine.
					Noon	29.72			
	Lady Sale.	10.44	81.24′	Fine Weather.					
	Futtle Rozack.	9.39	78.37′	Gradually becoming fine, Wind S. E. b. E.		29.60	29.22		4 P. M. heavy clouds to the S. E.

PART III.

I now proceed to state briefly the grounds upon which the tracks of these Cyclones are laid down on the Chart, beginning with that of the *Sir Howard Douglas.*

I have first given the logs of two vessels to the Eastward, the *Isabella Blyth* and *Wellesley*,* of which the first certainly had the rearward swell† of the advancing Cyclone on the 15th, when the outer circumference of its S. E. quadrant might have been at about 120 miles from her position; and Captain Baylis very truly conjectures from the "confused heavy swell from the Westward" which was that of the Cyclone, and the lesser swell from the Eastward which was occasioned by the Trade wind, that "it must have been blowing hard somewhere to the Westward" of his position.

The *Wellesley* it will be recollected, was also a homeward bound ship, but she was on the 12th in 10° 43′ South and had then had the commencement of her gale since the 11th. As on the 12th she had the wind at N. N. W. which makes the centre bear from her W. S. W. it is difficult to suppose, without any intermediate evidence, that her Cyclone, if it was one, was the same as that of the *Sir Howard Douglas* on the 15th. I have therefore marked her track on the Chart rather as giving another laudable instance of the caution necessary in this dangerous tract of the Ocean.

We now come to the three ships near to which the centre must have passed between the 15th and 16th which are the *Sir Howard Douglas Admiral Moorsom*, and *Polly*, all of which had, by noon on the 15th, the Cyclone evidently commencing with strong gales from the S. E. and were running up to the Northward to cross in front of it, in entire ignorance of their danger in so doing. But of these three ships the position of the *Polly* is as we shall see altogether uncertain, and that of the *Admiral Moorsom* also, on the next day, is a mere estimation. Taking as nearly as

* A statement, from memory, by the master of the Barque *Iris* was also forwarded to me by Captain Twynham; but this vessel was on the 10th, in 12° South and 90° East when the weather became so suspicious as to induce Captain Twynham to believe he was passing near a Cyclone to the Westward of him, which indeed may have been the case, but it was not that of the *Sir Howard Douglas*; and as no Barometrical observations were made it is not certain even that it was a Cyclone. It might have been the *Wellesley's*.

† See Col. Reid's new work on Storms and the Variable Winds.

may be, a mean position for the centre of the Cyclone from the imperfect data given in the logs I should place it at this time in Lat. 9° 5′ S.; Long. 81° 55′ East; and as it passed a little after midnight close to the Northward of the *Sir Howard Douglas*, when she was upset, its rate of travelling may have been not quite 11 miles an hour, on a W. S. W. course. I have also marked the position of the *Sir Henry Pottinger*, as given by Captain Baylis, but as he does not say at what time on the 14th, nor with what wind she cut away her foremast, we can only infer that the Cyclone certainly came down from the E. N. E. as we have marked its track and that probably she was close to, or at its centre.

We then find that it passed close to the North of the *Polly*, and to the South of the *Admiral Moorsom* between 3 P. M. of the 15th and 5 A. M. of the 16th; though the positions of the vessels must be to some extent uncertain, as they were all running at night before a furious gale increasing rapidly to a hurricane; when all hands in a merchantman have full employment, and the log is usually marked the next day from recollection. We may infer that the *Sir Howard Douglas*' run is perhaps under-marked, for this direction of the track makes the centre pass at 33 miles distance from her, and from her log and low Barometer she may have been somewhat closer to it; judging also from the rapid veering of the wind with her after she went over.

After the track is carried past this group of vessels we have no farther data than the Log of the *Strabane*, which ship no doubt experienced the same Cyclone, for we see from Captain Anderson's well kept notes* that he was watching and noting the atmospheric indications on the 16th; and it is highly instructive to compare his remarks on the sea of the advancing storm with those of Captain Baylis of the *Isabella Blyth* in its rear, to see how perfectly good observers on opposite sides of the same Cyclone are warned of its approach or vicinity by these too-much-neglected signs.

The Log of the *Victoria* is so imperfect as regards position that we

* They are still but notes, and I should have been glad to have had the whole Log with them, for the point at which the track of the Cyclone crosses the ship's track is somewhat uncertain, because we have not her exact run, hour by hour to calculate with, but only the distance from noon to noon, whereas she was no doubt going much faster in the first than in the latter part of this twenty-four hours.

can make no use of it, farther than to say that it seems pretty closely to corroborate our estimation of the track ; for from where she is marked in the Chart on the 15th (which is still but an approximate position) she had only to run down with the North Westerly gale which she must have had thereabouts, to plunge into and cross the track of the Cyclone in its rear as she evidently did. Her damage and narrow escape from foundering, as well as that of the *Sir Howard Douglas*, and the narrow escapes of the *Polly* and *Admiral Moorsom* from far worse loss than they suffered, are all instances of lamentable error; for they might all have escaped with a close-reefed-topsail breeze by heaving to for six hours, or if in the cases of the *Polly* and *Admiral Moorsom* they had thought it right, upon cool calculation, to risk crossing in front, they should have kept to the Westward far enough to maintain their Barometers without any farther fall, and even to raise them a little ; without which their running was decidedly unsafe ; and was indeed at no time worth the risk for the short amount of time and distance which it could have saved.

Returning to the details of the track : We find that noticing carefully the indications of the weather the *Strabane* ran up from Noon of the 16th to Noon of the 17th on a N°. 30° East course, so as to cross in front of the Cyclone and allow it to pass astern of her.* She had the wind about South at Noon, placing the centre (*if* the Cyclone had commenced) due East of her and veering to West and finally to "a furious gale" at N. W. at midnight ; so that the Cyclone had passed just astern of the vessel in the interval between Noon and midnight.

As before noted we have not the exact run, neither have we the hours at which the winds were certainly at the points marked ; so that we cannot exactly lay down the point at which the Cyclone's track crossed that of the ship, but as her position is carefully given, there is no doubt that, from that of the *Polly* and *Admiral Moorsom* the track

* Which however was done too closely for perfect safety ; a North course or even one to the N. b. W. would have been a safer one, as carrying the ship more rapidly across the line of the track, which she would have possibly have done so as to run easily to the N. Eastward when the Westerly part of the vortex reached her. In questions like this however, all depends upon the point at which a vessel in a heavy breeze and sea steers best, and what the heave of the sea is.

curved considerably to the Southward and again to the North, to pass as it did so close to the South of the *Strabane*, so as to bring the wind from South to North West in 12 hours, and to depress her Barometer from 29.50 to 29.40.*

With regard to the rate of travelling we can only say that it seems evidently by the short duration of that part of the Cyclone which was of hurricane violence, and judging also from the estimated positions of the centres on the 15th and 16th, and midnight of the 16th and 17th that it cannot have been below 15 or 16 miles an hour. The rapid and sudden fall of the Barometers of the *Polly* and *Admiral Moorsom* within a short period shews that, for them, the more violent part was of limited extent but proportionably severe. The Barometer of the *Sir H. Douglas* did not indicate this peculiarity, but it may have been a more sluggish instrument.

A curious remark is made at the close of the *Polly's* Log, viz. that the observations between the 15th and 19th shewed that the ship must have been drifted *four degrees* to the Westward in the hurricane! Now this is scarcely possible, for the other ships would also have been carried to the Westward and no doubt have noticed it, to say nothing that the *hurricane* part of the storm did not last more than 24 hours at most, so that we must suppose here a storm wave of 10 miles an hour! which is quite unprecedented. I should rather suppose some error in the observations? or that the Chronometer had been injured during the Cyclone? We must not forget however that this throws much uncertainty on the *Polly's* position, and thus our track may not have been quite so abruptly curved as we have made it. Yet it is clear that we have yet much to learn regarding the tracks in this quarter of the Ocean; and such a one as is shewn by these ships' Logs *may* doubtless occur, and the Mariner has here another caution when a Cyclone is commencing with him.

The Jumna's Cyclones.

The following are the considerations upon which the track of these Cyclones are laid down.

* By a Barometer diagram which is sent with the extract the Barometer seems to have been at its lowest at about 3 A. M. of the 17th (probably an error) though the Log states it to have risen after midnight. The Simpiesometer both by the Log and diagram appears to have been lowest at about midnight.

We find, that on the 21st of April, the *Braemar* in 6° 43′ S. and 88° 10′ East had cloudy weather with a confused sea; and the wind from N. E. to East, her Barometer being still at 29.77; and that the *Samarang, Lady Sale* and *Sultany* all very near each other, but 140 miles to the S. W. of the *Braemar* had also strong Northerly and N. Easterly breezes, increasing, and with squalls, and their Barometers falling; and by midnight they were all preparing for bad weather. We cannot from this infer anything as to the existence of a Cyclone to the N. Westward of them on this day at Noon, and indeed had any existed it would have been felt by the *Jumna* and *Salween*, both of which were in that direction, the *Salween* being only 130′ to the W. b. N. of the *Braemar*.

But at 320 miles to the S. West of the *Braemar* and 180 to the S. West of the *Sultany, Lady Sale* and *Samarang*, it appears that the *Futtle Rozack* having had the wind in strong squalls from N. E. to E. S. E. and S. E. at Noon, had by 5 P. M. strong gales with heavy gusts, turbulent swell and confused sea, with her Barometer at 29.55 and 29.54. At midnight it did not fall more, because she was still running to the W. S. W. and S. W. and out of the Cyclone circle, if we take it now to have been one, as it seems by her Log to have just commenced, or formed, (or *descended*) somewhere to the N. W. of her.

It was midnight also before the *Pemberton* began to experience any bad weather. She being at this time perhaps with the light winds and calms described in the note, in about $7\frac{1}{2}$° S. and 82° 50′ East, and indeed, if the winds are correctly noted in the newspaper account, which was no doubt the Captain's report, the Cyclone of this ship and the *Deborah* was a small one travelling rapidly to the S. East, a very unusual track hereabouts. I shall revert again to these vessels and I notice them now merely to shew that, for this day, the *Pemberton's* position could have no relation to the *Futtle Rozack's* bad weather. The newspaper position I take to have been as usual *about* where the gale was most severe, and Mr. Meldrum's to be the calculated position at noon of the 22nd, and that the date given by the Captain is that of the worst weather on the 23rd, when the vessel had drifted back to the Northward.

On the 22nd of April, we find that the *Braemar* had run down 160 miles to the S. S. W. and South with fresh gales and drizzling rain from the N. E. b. E. to N. East, and a high rolling sea; her Barometer

falling from 29.74 at Noon to 29.54 at 4 P. M. The next ships to her are:—

The *Samarang* 200 miles to the W. S. W. with the wind about E. N. E. The *Sultany* about 130 miles to the W. b. S. and the *Lady Sale* about 115 miles to the W ½ S. with the wind about E. N. E. and these vessels had all by noon gales, or every indication of bad weather. The note of the *Deborah* affords us no information as to the weather on the 22nd, and the *Pemberton's* has no position. As however, both these vessels were from Bombay we may take them, like the *Jumna*, to have been running down to the S. b. W. or S. S. W. at most, to get the trade wind as soon as they could. The bearings of the centre from the ships *Samarang*, *Sultany* and *Lady Sale* will not cross so as to meet at any point near enough to assume it as a centre, and if the centre was at all distant the circle would include H. M. S. *Jumna* and the H. C. P. V. *Salween*. And we know of the first that she "had the usual fair (westerly) winds with heavy squalls thunder and lightning" till the 23rd of April, and of the *Salween* at 170 miles to the N. N. W. of the *Braemar*, that though, as with all the ships, she had very threatening appearances, yet it was fine enough to allow her to speak the *Jumna*.

Hence we may suppose that, if the Cyclone was formed at Noon of this day, it was only so overhead, and was settling down: perhaps unequally; i. e. with its S. Eastern and Southern quadrants more inclined to the earth than the Northern and North Western ones; or that the Westerly Monsoon was still strong enough to the Northward to force its way beneath and impede the due surface action of that side of it. I do not mean as regards the wind, but as regards its electric action. The mere winds only would have assisted each other, both being from the Westward. We cannot thus fairly assign any centre to this Cyclone for the 22nd.

We find that the *Futtle Rozack*, which ship on the 21st had every indication of a Cyclone to the Northward and Eastward of her, ran on to the S. W. with the S. Easterly gales of its S. West quadrant till her Barometer fell to 29.48; and at 10 A. M. bore up to the N. W. to get out of it, bringing the wind to S. S. E. at 5 P. M. and to S. ½ East and S. east at midnight, so that we may suppose, with so accurate an observer as Captain Rundle, and the full detail of his careful obser-

vations that there really was a smaller precursor Cyclone in his wake as he supposes, on the 21st and 22nd, and that it passed near to the *Hardwicke* by the imperfect newspaper notice which I have obtained, that ship being only 25 miles to the South a little East of the *Futtle Rozack.*

On the 23rd of April.—Taking the ships now from the Westward* we see that the *Deborah* had on this day a small Cyclone centre crossing her which is called a hurricane, and lasted for four hours only. It is difficult to say from such scant information if this had any relation to the next ship's hurricane, the *Pemberton,* which appears from Mr. Meldrum's account to have had the centre of the Cyclone passing over her not far from the spot of which he has given the Lat. and Long. on the 22nd, but as we are quite in the dark as to whether she was running or hove to; and as the copy of his letter sent me from Bombay differs from the newspaper report, we can merely take the whole as a *sort* of confirmation, but nothing else. The shift given by the newspaper report, N. N. W. to W. S. W. would also give a Cyclone track to the S. E. like that of the *Deborah;* and as the *Pemberton* was a cotton-laden ship bound to England, she probably ran on as long as she could do so under the temptation of the fair wind from N. N. W. I should take the *Deborah's* to be a separate Cyclone of small dimensions, but it is scarcely possible to trust to these scant, and so frequently erroneous newspaper notices.

We have next the Log of the *Lady Sale,* but unfortunately her positions are only given on the 21st and 24th, and the extract from her log giving no distances run, or rate of drift, I cannot work up the dead reckoning. We can only then estimate roughly that as her track and drift cross that of the Cyclone, and as she was evidently hove to close on the western verge of the centre at 4 P. M. on the 22nd, she had probably run down about 200 miles from her position on the 21st before she hove to; which would place her at that time, i. e. 2 A. M. 23rd, in Lat. 9° 44′ S.; Long. 83° 43′ East, when, as the wind is marked due East in her log, she had the centre North from her, and between this time and noon of the 23rd the centre, as we see from

* Because from the shifts given in the notices of the *Deborah, Pemberton* and others, N. E. *to* S. W., it is clear that their Cyclone was travelling *to the S. Eastward!* a very unusual track, but one fully shewn to be correct by all the Logs.

the veering of the wind, was passing her close to the N. Eastward while she was hove to; the Cyclone leaving her with a strong breeze only, from the Southward, by noon of the 23rd, when she might be about 172 miles West from the position of H. M. S. *Jumna* at that time, which would give about 150 miles for the semi-diameter of the Cyclone taking the *Jumna* to have been at noon close on the eastern verge of the centre.

The next ship, and she must have been not far from the *Lady Sale*, is the *Samarang*. We find that her Easterly gale had increased to a hurricane from E. b. N. by 8 P. M. of the 22nd; and that at midnight her Barometer had fallen to its lowest, 29.39, with the wind about E. S E. veering to South at 8 A. M., and moderating with the Barometer at 29.50 by Noon. Hence it is clear that the centre passed her to the Eastward, and if we take the average strength and shift of the wind to have been from E. N. E. when it is described on the 22d as an increasing gale, obliging the ship to be hove to, to South, this would give a S. E. b. E. course for the body of the Cyclone.

We have then the *Sultany* to the N. Eastward in about 9° 32′ S.; and about 83° 27′ East, or not quite midway from the *Pemberton* and *Deborah*, a little more than 100 miles N. E. of the *Lady Sale*, and not quite 100 miles N. West of the *Jumna;* and we find that at noon, in about this position, she must have been *at* the centre since she had "the wind all round the compass with a dreadful sea and thick dense atmosphere, the vessel lying with her lee gunwale in the water."*

H. M. S. *Jumna*, to which we now come, has her position also as well ascertained as that of vessels can be in weather of this nature, and so far better than the *Sultany's* that the *Jumna* was going free and the *Sultany's* drift only can be estimated. We see that she was at the distance of 98 miles to the S. E. b. East of the *Sultany*, which would have given her *if she had the same Cyclone* a N. E. b. N. wind, instead of which we find she had one to the Westward of North that is N. N. W.! at Noon, or one differing five points. This is not reasonably reconcileable and we may either suppose that H. M. S. *Jumna* had a smaller Cyclone travelling down with her, in her run on this day, and that it was about the spot where the *Sultany's* and

* The *Sultany* is one of the finest ships out of the Port of Calcutta, of 1000 tons burden, and ably commanded. We see that she was fully prepared for the hurricane, though from its unusual track she was involved in it.

Jumna's Cycloues met that the latter vessel was upset, or that there were some excessive incurvings of the winds with her at this distance from the centre.*

For we find by the *Jumna's* Log that she had the usual fine and squally weather up to 3 A. M. on the 23rd, when it came on to blow from the N. West; and at 5, veered to West; at 6, to W. N. W.; and at ½ past 8, to Noon it was N. N. W. and P. M. N. b. W.

Now the *Sultany* before, and up to Noon, had her Cyclone to the N. W. of her position, and though it is true that a storm circle which would include the *Braemar* and *Mary Stoddart*, both of which ships had a full hurricane on the 23rd, would also include the *Jumna's* position and run, yet it is difficult to allow so great a discrepancy in the position of the centre as denoted by the wind points shewn above; and this is farther strengthened by the fact that the winds on board the *Jumna*, though marked most carefully (nine times in the 24 hours on the 22nd, and twelve times in the Log of the 23rd), are never to the Eastward of North; which we certainly must suppose they would sometimes have been if the bearing of the centre had been so far to the North Westward of the *Jumna* as the *Sultany's* position, whether over or under-stated, shews. We may also remark that even *at* the calm centre and close upon it the *Jumna's* Log shews only vibrations of two points till the wind finally settled at S. W. after the shift.

Thus we are reduced to the first supposition, which is that the *Jumna* was bringing down with her another small Cyclone, and if we admit this, and that it was for a time travelling on a track gradually approaching her as shewn by the steady fall of her Barometer, we can easily understand that at the point where the two approximated and combined, the fury of the tempest might be much augmented and the track subject to some variation.† I proceed to examine the *Jumna's*

* Five points is not an excessive incurving of the wind when *near* the centre, but at this distance it would seem to be so. See Sailor's Horn Book, pp. 70 to 75, on the incurving of winds. The wind was of course accurately marked on board of the Man-of-War, and I do not recollect that we have any detailed Log of a Man-of-War in recent days in the Eastern Seas in an open Ocean. Those of H. M. S. in the China Seas cited in my Seventeenth Memoir are all within a short distance of the land.

† This certainly occurs with hail storms, as satisfactorily shewn by the Count de Tristan in the Annales de la Societé Royale d'Orleans. See Quarterly Journal of Science for 1829, p. 214.

Log more closely so as clearly to set forth the reasons on which this opinion is founded. We shall find moreover that the *Braemar's* Cyclone was a separate one from those of the *Jumna* and *Sultany*.

First: we have her position at 3 A. M. of the 23rd as marked on the chart when it "came on to blow." The wind is marked at *N. W.* in the Log* and West at 5 A. M. though the copy of Lieut. Rodney's Admiralty letter forwarded to me by H. E. the Naval Commander-in-Chief, says "a heavy gale sprung up *at North*, veering at times to N. N. W." This is, at starting, a troublesome discrepancy, but I reconcile it by supposing that North *West* was written at full length in the letter and the word *West* omitted by the copying clerks; for it is difficult to suppose that three copies of the Log by different hands are all in error. The wind is also marked N. W. from 9 P. M. to midnight on the 22nd. The Barometer at 29.64 at midnight 22nd and 29.57 at 3 A. M. 23rd; and the wind increasing from a force of 5 to 7 and 8.†

Hence we may say that the *Jumna* had a sudden onset of a fresh gale, at N. W., giving her a centre bearing S. W. of her at 3 A. M.; which by 5, when she had run 27 miles to the South and S. S. W., was bearing South of her (wind West) and in a run of 14-4 miles it was bearing S. S. W. of her, (wind W. N. W.) and in a run of 43 miles more, it was bearing W. S. W. of her, (wind N. N. W.)

We can only account for these excessive veerings by attributing them either to incurvings of the winds or to the action of a smaller Cyclone‡ travelling down with the ship, I prefer the latter hypothesis, and have therefore placed upon the chart a separate diagram upon a plane scale shewing the *Jumna's* run, and the various bearings of the Cyclone centre from her at different hours, with the height of her Barometer.

* Three copies in all.

† Admiral Beaufort's Numbers. 5 is a fresh breeze, 8 a fresh *gale*.

‡ Of which we may suppose the centre to have had that spiral motion upon itself during its progress described by Mr. Redfield, making thus the meandering track which I have laid down in the diagram; and even that these deviations from a direct line of track were occasioned by the alternate attractions and repulsions of the larger (*Sultany's* and *Braemar's*) Cyclones on each side of it, as with other electrified masses. It is evident that the three cannot be reconciled as one Cyclone till about the time of the *Jumna's* being dismasted. There is indeed one other, but a remote suspicion: namely, that her compasses may have been affected?

H. M. S. now ran down with the wind N. N. W. and N. b. W. till 4 P. M. when she reached the calm centre, but the Cyclone following her and probably before this time combining with the *Sultany's* and *Braemar's* gave her a renewed hurricane at W. S. W. and S. West, when unable to lie to any longer she bore up, with the wind now blowing harder than the figure 12 expresses, *though it had only been rated at* 10 *before the calm.* This average shift of N. N. W. to S. W. would give a track of E. S. E. for the body of the Cyclone at this time, though as compared with the position of the *Sultany*, not far from which one of the main Cyclones had certainly travelled down to reach the *Jumna's* here, the track should have been one from the N. W. b. N. to the S. E. b. S. so that if there was a junction of the three Cyclones as we have supposed, the track of the larger one was curved towards the smaller. The *Jumna* scudded before the S. W. hurricane till 10h. 45′ P. M. when broaching to, she upset and was only saved from foundering by cutting away her mainmast. It is remarkable also that her Barometer was now lower, being at 29.16, than in the calm, when it was at 29.21. Was this an effect of the meeting of the *Braemar's* Cyclone?

The Cyclone *may* indeed have curved farther to the Eastward, as we shall now see on consideration of the *Braemar's* Log, which, I should premise, is one very well kept, and evidently worthy of all the credit which can be fairly accorded to a merchantman's Log in comparison with that of a Man-of-War. This ship then, on the 22nd at Noon, though her Barometer was still high had fresh gales at N. E. with drizzling rain and a high rolling sea, which was no doubt the commencement of her Cyclone, for at 8 it was "increasing with heavy seas* from the N. West, S. E. and S. W." obliging her to close reef; the Barometer having fallen to 29.54 by 4 P. M. and standing at 29.58 at midnight. Hence it would appear that she had at Noon a Cyclone to the N. W. b. N. of her (wind N. E. b. E.) and that at midnight its centre bore N. West of her, the wind being N. E., so that though she had run $46\frac{1}{2}$ miles S. S. W. and 37 miles South, the Cyclone had travelled down nearly with her like the *Jumna's*. I have projected these circles but in part only, so as not to interfere with those of the *Jumna's* track, though it must be recollected that at midnight 22nd and

* The precursor swells of the Cyclone.

23rd, the centre of the *Braemar's* Cyclone is about 100 miles to the South of the *Jumna's* probable position at the same time. And this too serves to shew that, like the *Jumna's* Cyclone, that of the *Braemar* was also of small extent, for had it been large it would have reached the *Jumna* at this time with its northern quadrants, giving her a N. Westerly gale of the same force; and that at noon of the 22nd the *Jumna* could not have been far from its centre if it had existed; whereas we find that she had at that time Northerly and variable winds (force 6) with cloudy weather, and it was not until 15 hours afterwards 3 A. M. 23rd, that it "came on to blow."

There can be no doubt, also, that the *Braemar's* Cyclone travelled down nearly with her, i. e. from the N. N. E. to the S. S. W.; for as from noon to midnight of the 22nd, she made a chord of 95 miles this would have given her a very considerable veering of the wind had the Cyclone been coming direct towards her.*

At 8 A. M. there is the remarkable note in the *Braemar's* Log of "gale suddenly increasing," and the Barometer had fallen at Noon to 29.45, from 29.58 at midnight; and we find that at 9 A. M. the wind with the *Jumna* veered from W. N. W. to N. N. W. increasing in strength from 9 to 10. We may take this, I think, to be about the time of junction of the two, or of the three Cyclones, as that of the *Jumna* now seems to have adopted a steady course to the Southward as if it had been before attracted and repelled between the *Sultany's* and the *Braemar's*, which accounts for its serpentine track as shewn in our diagram. The land whirlwinds and simoons certainly make tracks of this kind, and in hail storms and thunder storms clouds are sometimes seen attracted and repelled between two others. So that on the supposition that the Cyclone is an electrical phænomenon, there is nothing at all strange in this track of the *Jumna's*, and we may think ourselves very fortunate that we have so many Logs and notices to explain it.

The main Cyclone evidently after this time, (Noon 23rd) passed to the Northward of the *Braemar;* which ship was probably carried

* A Cyclone of 100 miles in diameter requires in round numbers a run of 10 miles for each point which the wind veers; one of 200 miles about 20′, so that the *Braemar's* Cyclone could only be travelling parallel to her, and at about her own rate.

first to the South Westward and then back to the Northward by her drift and the storm currents; being so near the centre as to have the wind veering from E. N. E. to S. E. blowing a hurricane at midnight when H. M. S. *Jumna* was also in the adjacent quadrant running out of the circle, with her foremast only standing since 10h. 45′ P. M. From the direction of the wind—and taking also into account the little attention which *can* be paid to a merchantman's Log on the approach of bad weather, so that it is very often undermarked, it would seem that the *Braemar* must have been much farther to the Southward than her Lat. and Long. by D. R. place her, but I have not thought it right to alter her position on a mere probability. There can be no doubt that she was close on the Southern and S. Western quadrants of the centre both from the rapid veering of the wind and its extreme violence, obliging her at 3 A. M. of the 24th to cut away her mainmast.

From the Log of the *Mary Stoddart*, there is nothing to be gleaned except that she had also a Cyclone *thereabouts** travelling to the South Eastward. The notice of the *Ormelie* may relate either to a heavy Westerly monsoon gale or to the Northern quadrants of the *Mary Stoddart's* Cyclone.

As the phænomenon of the vibrating track of the *Jumna's* Cyclone as marked on the chart is of much importance in our science if we allow that it really took place as I have endeavoured to shew, I have thought it right to print also the Log at full length; or rather *a* Log compounded of the three separate ones in my possession by filling up in Lieut. Rodney's Log of the weather, Bar. and Ther. the distances. I have no Log enabling me to give the run on the 22nd, or afternoon of the 24th, but this is immaterial.

I have noted carefully where discrepancies occur, but fortunately in all the main points as regards the veerings of the wind they all agree, and it is this alone which is of interest to this part of the investigation. The remarks of the Log I have condensed with the abridgement in Part II.

* For, to add to our perplexities with these scant notices, some Captains give the Latitude and Longitude of their position when they consider the hurricane to have *begun* with them, and others their position when it is at its utmost fury; so that a hurricane *in* such a position means at either of the above times! and the two positions may be at any distance apart.

An extract from the Log of H. M.'s Brig " JUMNA," *shewing the state of the weather, Barometer, and Thermometer between the 22nd and 24th April,* 1848—*from* LIEUT. RODNEY, *Trincomalee : the distances on the 23rd and 24th, also from the official copy of the Log.*

Hours.	*Courses.*	*Winds.*	*Force.*	*Weather.*	*Bar.*	*Ther.*	*Saturday 22nd April,* 1848.
1	South	Variable	3	c. n. e.			A. M.
2							
3							
4		N. W.	4	c. p.	29.72	82°	
5							
6		West	5	c. q. m.			
7							
8			5	c. q. 8	29.74	82°	Squally.
9							
10		North	6	o. c. q. r.			
11							
12				b. c. q.	29.73	82°	
1		Variable	6	o. p.			P. M.
2	S. W.						
3			6	o. r.			
4		North			29.62	82°	
5							
6	S. S. W.						
7	S. W. ½ W.	West	6	c. r.			
8	S. S. W.	W. N. W.			29.66	83°	
9		N. W.	6	o. q.			Very squally.
10							
11							
12			5	o. r.	29.64	82°	

Hours.	Courses.	K.	F.	Winds.	Force.	Weather.	Barometer.	Thermometer.	Sunday 23rd April, 1848.
1	S. S. W.	9	0	N. W.	6	c. q. r.			A. M.
2		9	0						
3		9	0						
4	South / S. S. W.	3 / 5	5 / 0		7 / 8		29.57	82°	
5		9	4	West					
6		9	4	W. N. W.*					
7		10	5		9				
8		12	0				29.53	82½°	
9		11	5	N. N. W.†	10	o. q. g. p.			
10		11	5						
11		10	0						
12		11	5				29.33	82°	
				Lat. D. R. 10° 28′ S.			*Long. D. R.* 85° 00′ E.		
1	S. S. W.	13	0	N. b. W.	10	o. q. g.	29.33	82°	P. M.
2		13	0				29.31	82°	
3		10	8	N. N. W.	9	o. q. g.			
4	South	6 / 3	0 / 2	Calm	7 / 0		29.21	82°	Wind increasing.
5	S. b. W.	6	0	W. S. W.	6				
6	S. b. E.	2 / 3	8 / 3	West	7 / 6	o. q. r.	29.19	82°	
7		3	0	S. W.	9				
8		3	0	W. b. S.	10		29.18	82°	
9	S. b. E. / N. E.	2 / 5	2 / 0	S. W.	10	o. q. g.	29.16	82°	
10		11	0		11 / 10	o. q. g.	29.18	82°	
11		14	0		12		29.16	82°	
12		14	0		12		29.16	81°	

* Wind W. N. W. is marked at 5, ½ past 5 and 6.
† Wind N. N. W. is marked at 9. 10 and 11 A. M.

Hours.	*Winds.*	*K.*	*F.*	*Courses.*	*Force.*	*Weather.*	*Barometer.*	*Thermometer.*	*Monday 24th April, 1848.*
1	S. W.	14	0	N. E.	12	o. q. l. t.	29.16	81°	A. M.
2	S. W. b. S.	14	0	N. E. b. N.					
3		14	0				29.18	81°	
4	S. S. W.	14	0	N. N. E.	11	o. q. r.	29.16	81°	
5	S. W.	5	0	N. E. b. E.	8	o. q.	29.18	82°	
		1	5	E. b. N.	6				
6		2	0		3		29.22	82°	
7		1	0		4		29.24	82°	
8		2	5	N. E.			29.27	82°	
9		1	5	N. N. E.			29.37	82°	
10		1	5				29.40	83°	
11		1	0						
12		1	0	*	4		29.42	83°	
1	N. W.			N. b. E.	5	o. q. g.			P. M.
2	W. N. W.								
3							29.63	82°	
4									
5	West			N. b. E.	1	o. r. n.			
6				North					
7				N. b. E.	6	o. q.	29.62	82°	
8									
9									
10									
11				North.			29.71	82°	
12	W. $\frac{1}{2}$ S.				1	o. q.			

* No farther distances are in my possession.

Conclusion. We may first remark here, as regards the practical part of the results, that in both the Cyclones of which we have investigated the tracks, the single one of the *Sir Howard Douglas* and the triple combination of those which I have for brevity's sake called the *Jumna's, all* the ships which suffered did so from their neglect or ignorance of the Laws of our Science, for they had nothing to do but to heave to for a few hours! And again, as if they had all been performing experiments for the instruction of their brother seamen, the whole of them in the first Cyclone, the *Sir Howard Douglas, Admiral Moorsom,* and *Polly,* ran into the Cyclone circle from the South, the fair S. E. wind of the South Western quadrants tempting them to do so; and all those in the other Cyclone were doing the same on the opposite quadrants of their Cyclones, and exactly from the same temptation. And this it will be observed was constantly done in the face of their falling Barometers! It is I know very difficult for seamen to bend their minds to the notion of "*throwing away a fair wind because they are* AFRAID *of a hurricane,*" but we might also urge upon them that they may be creditably afraid of the displeasure of owners and underwriters, and of ruin to their own prospects, when the Barometer so clearly warns them that mischief is impending.*

As regards the theoretic or rather the physical branch of our enquiries we have arrived here at some very curious facts.

First, the tracks from the N. Westward and N. Eastward are corroborated by and corroborate those of the H. C. S. *Orwell* and *Macqueen* in 12° S.; and 100° to 104° East in January and February, 1827, which I have laid down on the Chart of the Tracks of the Southern Indian Ocean in the Sailors' Horn Book, (marked *i.* and *f.*) as well as some others farther East in the Timor Sea, shewing that just on the

* The Ship *Sir Howard Douglas,* dismasted and with loss of rudder being bound to Bombay with a cargo of coals, got into Galle, from whence she again started for Bombay; but while endeavouring to get round by the Southern passage, her coals heated, 95 days after being wetted in the hurricane! and she bore up for Calcutta where she had of course to be docked. She then went to Moulmein for a cargo of timber, where Captain Ogilvy, whose mind, as I saw, was much depressed by his misfortunes, died. The ship I presume reached home in safety, but the accounts of the voyage must have shewn a fearful loss for some one. All this might have been avoided by heaving to, at 6 P. M. for 6 hours!

verge of the Westerly monsoon and trade wind limits, great variation in the tracks is to be looked for.

Next, the serpentine course of the *Jumna's* hurricane most remarkably approaches to what we have upon record in various works describing the tracks of Tornadoes and land-spouts or whirlwinds (many of them evidently electric by their effects) and hail-storms. And the Comte de Tristan* has satisfactorily shewn in treating of this last class of phænomena, and of thunder-storms, that their clouds attract and cause each other to deviate from their route; often appearing stronger afterwards. We require farther evidence to affirm *certainly* that this occurs with Cyclones, but there are now strong probabilities that it does; and our present knowledge will serve to put the careful seaman on his guard till more is obtained, and afford many suggestions for intelligent observers.

Finally: all this we see occurs in the Storm Tract to which I have so often and so earnestly drawn the attention of mariners navigating the Indian Seas, and in which indubitably so many fatal losses and so much damage have occurred. And it must be now, evident to the most reckless that no ship can be too well prepared which has to cross these dangerous latitudes.

* Annales de la Societé Royale d'Orleans, before quoted p.

On the Dust-storms of India. By P. Baddeley, Esq. B. M. S., Surgeon Arty. Lahore.

(From the Philosophical Magazine and Journal of August, 1850.)

The Editor reprints this paper with great pleasure; not only as another of those triumphs of Indian research which have so often adorned the pages of the Journal, and so well demonstrated to the scientific world what the energy of English minds alone can perform, under all the discouragements and difficulties which the experimental sciences, particularly, must meet with at every step in a state of Society so peculiar as that of India, but moreover as a solution of a great meteorological problem which opens a new page of the Book of Nature in that vast and yet unwrought mine of science. We trust that Dr. Baddeley will continue his valuable researches in the great field which he has before him.—Ed. Jour.

Lahore, April 18, 1850.

Gentlemen,

I have only an hour or two to spare before the Indian mail leaves this, to give you a few notes regarding dust-storms, which are very prevalent in this part of India during the dry months of April, May and June, that is, before the setting in of the rainy season.

My observations on this subject have extended as far back as the hot weather of 1847, when I first came to Lahore, and the result is as follows :—Dust-storms are caused by spiral columns of the electric fluid passing from the atmosphere to the earth ; they have an onward motion—a revolving motion, like revolving storms at sea—and a peculiar spiral motion from above downwards, like a corkscrew. It seems probable that in an extensive dust-storm there are many of these columns moving on together in the same direction ; and during the continuance of the storm, many sudden gusts take place at intervals, during which time the electric tension is at its maximum. These storms hereabouts mostly commence from the north-west or west and in the course of an hour, more or less, they have nearly completed the circle, and have passed onwards.

Precisely the same phænomena, in kind, are observable in all cases of dust-storms : from the one of a few inches in diameter to those that extend for fifty miles and upwards, the phænomena are identical.

It is a curious fact that some of the smaller dust-storms occasionally seen in extensive and arid plains, both in the country and in Affghanistan above the Bolan Pass, called in familiar language " Devils," are either stationary for a long time, that is, upwards of an hour,

or nearly so; and during the whole of this time the dust and minute bodies on the ground are kept whirling above into the air. In other cases these small dust-storms are seen slowly advancing, and when numerous, usually proceed in the same direction. Birds, kites and vultures, are often seen soaring high up, just above these spots, apparently following the direction of the column, as if enjoying it.* My idea is, that the phænomena connected with dust-storms are identical with those present in waterspouts and white squalls at sea, and revolving storms and tornadoes of all kinds; and that they originate from the same cause, viz. moving columns of electricity.

In 1847, at Lahore, being desirous of ascertaining the nature of dust-storms, I projected into the air an insulated copper wire on a bamboo on the top of my house, and brought the wire into my room, and connected it with a gold-leaf electrometer and a detached wire communicating with the earth. A day or two after, during the passage of a small dust-storm, I had the pleasure of observing the electric fluid passing in vivid sparks from one wire to another, and of course strongly affecting the electrometer. The thing was now explained; and since then I have by the same means observed at least sixty dust-storms of various sizes, all presenting the same phænomena in kind.

I have commonly observed that, towards the close of a storm of this kind, a fall of rain suddenly takes place, and instantly the stream of electricity ceases, or is much diminished; and when it continues, it seems only on occasions, when the storm is severe and continues for some time after. The barometer steadily rises throughout. In this part of the world, the fluctuation of the barometric column is very slight, seldom more than two or three tenths of an inch at a time.

The average height at Lahore is 1·180, corrected for temperature, indicating, I suppose, above 1150 feet above the level of the sea, taking 30 inches as the standard.

A large dust-storm is usually preceded by certain peculiarities in the dew-point, and the manner in which the particles of dew are deposited on the bulb of a thermometer. My mode of taking the dew-point is, to plunge a common thermometer in a little ice, let it run down 20° or

* They may be looking for prey, or involved in, and unable to fly out of, the invisible part of the electrified aerial column, of which the lower part only is visible to us by the dust raised.—Ed. Journal.

30°, take it out, wipe it dry, hold it up to the light, and observe the bright spot, and continue to wipe off the dew so long as it is deposited and dulls the bulb: at the instant it clears off mark the temperature. This I have compared frequently with Daniell's hygrometer, cooled by means of chloroform, and find them both correspond with the greatest accuracy.

This is a digression; but I have no time to arrange, and must therefore put down my remarks as they occur to me.

The dew-point varies very much, but is usually many degrees below the temperature of the air, 20° to 50° or more.

It also varies according to the time of year. During November last the mean temperature of the dew-point was about 47°, that of the air about 71°.

In January 1850, dew-point 43°; in the air, 61°; and the mean temperature of self-registering thermometer 45°·4.

In February 1850, mean of dew-point 48°, and air 64°·5.

April 1850, mean temperature of dew-point so far, is about 60°, and the air 84°.

The sparks, or the stream of electricity, as it is seen passing from one wire to the other, is in some cases, and during high tension, doubled or trebled; and is never straight, but invariably more or less crooked.

Various kinds of sparks are seen; at times one end of the wire has a star; and from the wire, when held just beyond striking distance, a brush is seen curved, which, when viewed through a lens, seems composed of a stream or curved brush of bright globules, like a shower of mercury.

The manner in which the electricity acts upon the dust and light bodies it meets with in its passage, is simple enough. I suppose the particles similarly electrified and mutually repulsive, and then, together with the whirling motion communicated to them, are whisked into the air. The same takes place when the electricity moves over water. The surface of the water becomes exposed to the electric agency; and its particles, rendered mutually repulsive, are in the same way whirled into the air.

At sea the waterspout is thus formed. First of all is seen the cloud descending, and beneath may be observed the water in a cone, misty

and agitated; soon the cloud is seen to approach and join the latter, involving both extremities in one column having a spiral motion, and on it moves or continues stationary. The power of electricity in raising bodies, when combined with this peculiar whirling motion, will account for fish, &c. being carried up in its vortex and afterwards discharged to a distance on the earth. The motion of the dust-storm may be described by spinning a tee-totum on a drop of ink; and the way in which bodies are projected may be in like manner described, by letting fall a drop of ink on the centre of a tee-totum while spinning. In this case the particles of ink are thrown off at tangents ever varying, as the centre moves; and perhaps it will be found, that when these kind of storms pass through forests, trees uprooted are distributed something in this manner.

The violent dust-storms are by some supposed to commence at the foot of the hills. I cannot tell if this be the case or not, but should think that they do not necessarily do so, as many often originate in extensive arid plains; and the rarefaction of air, from great and long-continued heat, may be in some way connected with the exciting cause.

Some of them come on with great rapidity, as if at the rate of from 40 to 80 miles an hour. They occur at all hours, oftentimes near sunset.

The sky is clear, and not a breath moving; presently a low bank of clouds is seen in the horizon, which you are surprised you did not observe before; a few seconds have passed, and the cloud has half filled the hemisphere: and now there is no time to lose—it is a dust-storm, and helter-skelter every one rushes to get into the house in order to escape being caught in it.

The electric fluid continues to stream down the conducting wire unremittingly during the continuance of the storm, the sparks oftentimes upwards of an inch in length, and emitting a crackling sound; its intensity varying with the force of the storm, and, as before said, more intense during the gusts.

Many dust-storms occur at Lahore and in the Punjaub, generally during the hot and dry months, as many as seven and nine in one month.

One that occurred last year in the month of August seemed to have

come from the direction of Lica, on the Indus, to the west and by south of Lahore, and to have a north-easterly direction. An officer travelling, and at the distance of twenty miles or so from Lica, was suddenly caught in it; his tent was blown away, and he himself knocked down and nearly suffocated by the sand. He stated to me that he was informed by one resident at Lica, that so great was its force at the latter place, as to crack the walls of a substantial brick dwelling in which the above officer had lately resided, and to uproot some trees about.

The instant the insulated wire is involved in the electric current marked by the column of dust, down streams the electricity.

I have sometimes attempted to test the kind of electricity, and find that it is not invariably in the same state; sometimes appearing +, at other times –, and changing during the storm.

One day I caused the current to pass through a solution of cyanide of silver, so as to affect a small piece of copper, which was rapidly covered with a coating of silver, which upon drying peeled off. In this case the cyanide of silver was pure, without any salt; but in subsequent attempts to silver a wire in this way, I have not succeeded, only a very slight deposit taking place, which was not increased by long exposure to the influence.

But in all the cases I tried subsequent to the one first alluded to, the oxide of silver was dissolved in cyanide of potassium. In the course of time bright and minute crystals were formed, transparent and colourless, on a copper coin. Yours truly,

P. Baddeley,
Arty. Surgeon, Lahore.

Tables for determining Heights by the Barometer. Computed by Major J. C. Hannyngton, *B. N. I.*

These tables are so framed as to bring the logarithmic process into a purely arithmetical and very simple form.

They are to be used as follows:

Rule. Correct the Barometer at the *colder* station, by *adding* the correction from Table I. for the *difference* of temperature.

Extract the Barometric Factors from Table II., then according as the Barometer at the *lower* station is more or less than 30 inches, multiply the sum or difference of these Factors, by the Factor for the *sum* of the temperatures from Table III. The result will be the difference of altitude in feet.

Where great accuracy is desired a small correction for the approximate Latitude of the place may be applied from Table IV. This is to be added to or taken from the computed height, according as the Latitude is less or more than 45°.

		Barometers.	*Thermometers, attached.*	*detached.*
Example I.	Calcutta, ...	30.131	87	86
	Hazaribagh, ...	28.019	78	77
			Diff. 9	Sum 163

Barometer at the *colder* station,..	28.019		
Correction Table I. for Bar. 28, and Diff. 9, ...	.028		
	28.047	Factor Table II.	29.23
Barometer Calcutta, ...	30.131	,,	1.89
		Sum of the Factors,	31.12
Sum of Thermometer 163°.		Factor from Table III.	66.98
			24896
			28008
			18672
			18672
		Product, Hazaribagh above Calcutta, in feet,	2084.4176

Here it will be observed that the Barometer at the *lower* station *exceeds* 30 inches; therefore the *sum* of the Barometric Factors is used. The Latitude of Hazaribagh being 24° and the elevation 2000 feet, it appears from Table IV. that 3 feet may be *added* to the above result.

		Barometers.	*Thermometers. attached,*	*detached.*
Example II.	Lake,.....	29.950	50	49
	Mountain,.....	27.474	44	45
			Diff. 6	Sum 94
Barometer *colder* station,.....		27.474		
Correction for 6° Tab. I.		.017		
		27.491	Factor Tab. II.	37.93
	Lake,.....	29.950	„	0.72
			Difference of the Factors,....	37.21
Sum of Thermometers 94°.			Factor Tab. III. ..	62.36
				22326
				11163
				7442
				22326
			Product, difference of altitude in feet,.....	2320.4156

Here the Barometer at the *lower* station is *less* than 30 inches, therefore the *difference* of the Barometric Factors is used. The Latitude being 55° it appears from Table IV., that 2 feet may be subtracted from the above result.

Note on the construction of the Tables.

Let T and T′ be the temperatures of the mercury ; t and t′ those of the air, h and h′ the heights (after reduction by Tab. I.) of the Barometers, at the lower and upper stations, and λ the latitude of the place. Also let H express inches of the Barometrical column generally ; then,

Table I. H $\frac{T \backsim T'}{9600}$, being the correction of the Barometer for the expansion or contraction of mercury, depending on temperature. Which correction, being applied to the *colder* Barometer, is additive.

Table II. 1000 (209 30—209 H), and consequently the sum or difference of the tabular quantities taken for h and h′ is equivalent to 1000 (209 h—209 h′) ; five figure logarithms being used.

Table III. $60.345 \left(1 \pm \frac{t + t' - 64}{900}\right)$.

Table IV. $.002695 \cos 2\lambda$.

The result of the tables is therefore,

$$\text{Difference of level in feet, } (209\,h - 209\,h') \left\{ \frac{60345}{1 \pm .002695 \cos 2\lambda} \left(1 \pm \frac{t + t' 64}{900}\right) \right.$$

TABLE I.—*Correction of the Barometer for temperature.*

Difference of the Thermometers.	*Barometer Inches.*									Difference of the Thermometers.
	14	15	16	17	18	19	20	21	22	
	Correction to be added to the colder or subtracted from the warmer Barometer.									
0	.000	.000	.000	.000	.000	.000	.000	.000	.000	0
1	.001	.002	.002	.002	.002	.002	.002	.002	.002	1
2	.003	.003	.003	.004	.004	.004	.004	.004	.005	2
3	.004	.005	.005	.005	.006	.006	.006	.007	.007	3
4	.006	.006	.007	.007	.008	.008	.008	.009	.009	4
5	.007	.008	.008	.009	.009	.010	.010	.011	.011	5
6	.009	.009	.010	.011	.011	.012	.012	.013	.014	6
7	.010	.011	.012	.012	.013	.014	.015	.015	.016	7
8	.012	.013	.013	.014	.015	.016	.017	.017	.018	8
9	.013	.014	.015	.016	.017	.018	.019	.020	.021	9
10	.015	.016	.017	.018	.019	.020	.021	.022	.023	10
11	.016	.017	.018	.019	.021	.022	.023	.024	.025	11
12	.017	.019	.020	.021	.023	.024	.025	.026	.027	12
13	.019	.020	.022	.023	.024	.026	.027	.028	.030	13
14	.020	.022	.023	.025	.026	.028	.029	.031	.032	14
15	.022	.023	.025	.027	.028	.030	.031	.033	.034	15
16	.023	.025	.027	.028	.030	.032	.033	.035	.036	16
17	.025	.027	.028	.030	.032	.034	.035	.037	.039	17
18	.026	.028	.030	.032	.034	.036	.037	.039	.042	18
19	.028	.030	.032	.034	.036	.038	.040	.042	.044	19
20	.029	.031	.033	.035	.038	.040	.042	.044	.046	20
21	.031	.033	.035	.037	.039	.042	.044	.046	.048	21
22	.032	.034	.037	.039	.041	.044	.046	.048	.050	22
23	.034	.036	.038	.041	.043	.046	.048	.050	.053	23
24	.035	.038	.040	.042	.045	.048	.050	.052	.055	24
25	.036	.039	.042	.044	.047	.049	.052	.055	.057	25
26	.038	.041	.043	.046	.049	.051	.054	.057	.060	26
27	.039	.042	.045	.048	.051	.053	.056	.059	.062	27
28	.041	.044	.047	.050	.053	.055	.058	.061	.064	28
29	.042	.045	.048	.051	.054	.057	.060	.063	.066	29

TABLE I.—*(Continued.)*

Difference of the Thermometers.	*Barometer Inches.*									Difference of the Thermometers.
	14	15	16	17	18	19	20	21	22	
	Correction to be added to the colder or subtracted from the warmer Barometer.									
30	.044	.047	.050	.053	.056	.059	.062	.066	.069	30
31	·045	.048	.052	.055	.058	.061	.065	.068	.071	31
32	.047	.050	.053	.057	.060	.063	.067	.070	.073	32
33	.048	.052	.055	.058	.062	.065	.069	.072	.076	33
34	.050	.053	.057	.060	.064	.067	.071	.074	.078	34
35	.051	.055	.058	.062	.066	.069	.073	.077	.080	35
36	.052	056	.060	.064	.068	.071	.075	.079	.083	36
37	.054	.058	.062	.065	.069	.073	.077	.081	.085	37
38	.055	.059	.063	.067	.071	.075	.079	.083	.087	38
39	.057	.061	.065	.069	.073	.077	.081	.085	.089	39
40	.058	.062	.067	.071	.075	.079	.083	.087	.091	40
41	.060	.064	.068	.073	.077	.081	.085	.090	.094	41
42	.061	.066	.070	.074	.079	.083	.087	.092	.097	42
43	.063	.067	.072	.076	.081	.085	.090	.094	.099	43
44	.064	.069	.073	.078	.083	.087	.092	.096	.101	44
45	.066	.070	.075	.080	.084	.089	.094	.098	.103	45
46	.067	.072	.077	.081	.086	.091	.096	.101	.105	46
47	.069	.074	.078	.083	.088	.093	.098	.103	.108	47
48	.070	.075	.080	.085	.090	.095	.100	.105	.110	48
49	.071	.077	.082	.087	.092	.097	.102	.107	.112	49
50	.073	.078	.083	.089	.094	.099	.104	.109	.115	50
51	.074	.080	.085	.090	.096	.101	.106	.112	.117	51
52	.076	.081	.087	.092	.098	.103	.108	.114	.119	52
53	.077	.083	.088	.094	.099	.105	.110	.116	.121	53
54	.079	.084	.090	.096	.101	.107	.112	.118	.124	54
55	.080	.086	.092	.097	.103	.109	.115	.120	.126	55
56	.082	.087	.093	.099	.105	.111	.117	.122	.128	56
57	.083	.089	.095	.101	.107	.113	.119	.125	.131	57
58	.085	.091	.097	.103	.109	.115	.121	.127	.133	58
59	.086	.092	.098	.104	.111	.117	.123	.129	.135	59

TABLE I.—*(Continued.)*

Difference of the Thermometers.	*Barometer Inches.*									Difference of the Thermometers.
	23	24	25	26	27	28	29	30	31	
	Correction to be added to the colder or subtracted from the warmer Barometer.									
0	.000	.000	.000	.000	.000	.000	.000	.000	.000	0
1	.002	.003	.003	.003	.003	.003	.003	.003	.003	1
2	.005	.005	.005	.005	.006	.006	.006	.006	.006	2
3	.007	.008	.008	.008	.008	.009	.009	.009	.010	3
4	.010	.010	.010	.011	.011	.012	.012	.013	.013	4
5	.012	.013	.013	.014	.014	.015	.015	.016	.016	5
6	.014	.015	.016	.016	.017	.018	.018	.019	.019	6
7	.017	.018	.018	.019	.020	.020	.021	.022	.023	7
8	.019	.020	.021	.022	.022	.023	.024	.025	.026	8
9	.022	.023	.023	.024	.025	.026	.027	.028	.029	9
10	.024	.025	.026	.027	.028	.029	.030	.031	.032	10
11	.026	.028	.029	.030	.031	.032	.033	.034	.036	11
12	.029	.030	.031	.032	.034	.035	.036	.038	.039	12
13	.031	.033	.034	.035	.036	.038	.039	.041	.042	13
14	.034	.035	.036	.038	.039	.041	.042	.044	.045	14
15	.036	.038	.039	.041	.042	.044	.045	.047	.048	15
16	.038	.040	.042	.043	.045	.047	.048	.050	.052	16
17	.041	.043	.044	.046	.048	.050	.051	.053	.055	17
18	.043	.045	.047	.049	.051	.053	.054	.056	.058	18
19	.046	.048	.049	.051	.053	.055	.057	.059	.061	19
20	.048	.050	.052	.054	.056	.058	.060	.063	.065	20
21	.050	.053	.055	.057	.059	.061	.063	.066	.068	21
22	.053	.055	.057	.060	.062	.064	.066	.069	.071	22
23	.055	.058	.060	.062	.065	.067	.069	.072	.074	23
24	.058	.060	.062	.065	.067	.070	.073	.075	.077	24
25	.060	.063	.065	.068	.070	.073	.076	078	.081	25
26	.062	.065	.068	.070	.073	.076	.079	.081	.084	26
27	.065	.068	.070	.073	.076	.079	.082	.084	.087	27
28	.067	.070	.073	.076	.079	.082	085	.088	.090	28
29	.070	.073	.075	.079	.081	.085	.088	.091	.094	29

TABLE I.—*(Continued.)*

Difference of the Thermometers.	*Barometer Inches.*									Difference of the Thermometers.
	23	24	25	26	27	28	29	30	31	
	Correction to be added to the colder or subtracted from the warmer Barometer.									
30	.072	075	.078	.081	.084	.088	.091	.094	.097	30
31	.074	.078	.081	.084	.087	090	.094	.097	.100	31
32	.077	.080	.083	.087	.090	.093	.097	.100	.103	32
33	.079	.083	.086	.089	.093	.096	.100	.103	.106	33
34	.081	.085	.088	.092	.096	099	.103	.106	.110	34
35	.084	.088	.091	.095	.098	.102	.106	.109	.113	35
36	.086	.090	.094	.097	.101	.105	.109	.113	.116	36
37	.089	.093	.096	.100	.104	.108	.112	.116	.119	37
38	.091	.095	.099	.103	.107	111	.115	.119	.123	38
39	.093	.098	.101	.106	.110	.114	.118	.122	.126	39
40	.096	.100	.104	.108	.112	.117	121	.125	.129	40
41	.098	.103	.107	.111	.115	.120	124	.128	.132	41
42	.101	.105	.109	.114	.118	.123	.127	.131	.136	42
43	.103	.108	.112	.116	.121	.125	.130	.134	.139	43
44	.105	.110	.114	.119	.124	.128	.133	.138	.142	44
45	.108	.113	.117	.122	.126	.131	.136	.141	.145	45
46	.110	.115	.120	.125	.129	.134	.139	.144	.148	46
47	.113	.118	.122	.127	.132	.137	.142	.147	.152	47
48	.115	.120	.125	.130	.135	.140	.145	.150	.155	48
49	.117	.123	.127	.133	.138	.143	.148	.153	.158	49
50	.120	.125	.130	.135	.141	.146	.151	.156	.161	50
51	.122	.128	.133	.138	.143	.149	.154	.159	.165	51
52	.125	.130	.135	.141	.146	.152	.157	.163	.168	52
53	.127	.133	.138	.144	.149	.155	.160	.166	.171	53
54	.129	.135	.140	.146	.152	.158	.163	.169	.174	54
55	.132	.138	.143	.149	.155	.160	.166	.172	.177	55
56	.134	.140	.146	.152	.157	.163	.169	.175	.181	56
57	.137	.143	.148	.154	.160	.166	.172	.178	.184	57
58	.139	.145	.151	.157	.163	.169	.175	.181	.187	58
59	.141	.148	.153	.160	.166	.172	.178	.184	.190	59

TABLE II.—*Factor of the Barometers.*

Barometer fourteen Inches.				Barometer fifteen Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
14.00	330.99	14.50	315.75	15.00	301.03	15.50	286.79
.01	.68	.51	.45	.01	300.74	.51	.51
.02	.37	.52	.15	.02	.45	.52	.23
.03	.06	.53	314.85	.03	.16	.53	285.95
.04	329.75	.54	.56	.04	299.87	.54	.67
.05	.44	.55	.26	.05	.58	.55	.39
.06	.13	.56	313.96	.06	.29	.56	.11
.07	328.83	.57	.66	.07	.01	.57	284.83
.08	.52	.58	.36	.08	298.72	.58	.55
.09	.21	.59	.06	.09	.43	.59	.27
14.10	327.90	14.60	312.77	15.10	298.14	15.60	284.00
.11	.59	.61	.47	.11	297.86	.61	283.72
.12	.29	.62	.17	.12	.57	.62	.44
.13	326.98	.63	311.88	.13	.28	.63	.16
.14	.67	.64	.58	.14	296.99	.64	282.88
.15	.36	.65	.28	.15	.71	.65	.61
.16	.06	.66	310.99	.16	.42	.66	.33
.17	325.75	.67	.69	.17	.13	.67	.05
.18	.44	.68	.39	.18	295.85	.68	281.77
.19	.14	.69	.10	.19	.56	.69	.50
14.20	324.83	14.70	309.80	15.20	295.28	15.70	281.22
.21	.53	.71	.51	.21	294.99	.71	280.94
.22	.22	.72	.21	.22	.71	.72	.67
.23	323.92	.73	308.92	.23	.42	.73	.39
.24	.61	.74	.62	.24	.13	.74	.12
.25	.31	.75	.33	.25	293.85	.75	279.84
.26	.00	.76	.03	.26	.57	.76	.56
.27	322.70	.77	307.74	.27	.28	.77	.29
.28	.39	.78	.45	.28	.00	.78	.01
.29	.09	.79	.15	.29	292.71	.79	278.74

TABLE II.—*(Continued.)*

Barometer fourteen Inches.				Barometer fifteen Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
14.30	321.78	14.80	306.86	15.30	292.43	15.80	278.46
.31	.48	.81	.56	.31	.14	.81	.19
.32	.18	.82	.27	.32	291.86	.82	277.91
.33	320.87	.83	305.98	.33	.58	.83	.64
.34	.57	.84	.69	.34	.29	.84	.36
.35	.27	.85	.39	.35	.01	.85	.09
.36	319.97	.86	.10	.36	290.73	.86	276.82
.37	.66	.87	304.81	.37	.45	.87	.54
.38	.36	.88	.52	.38	.16	.88	.27
.39	.06	.89	.23	.39	289.88	.89	.00
14.40	318.76	14.90	303.93	15.40	289.60	15.90	275.72
.41	.46	.91	.64	.41	.32	.91	.45
.42	.15	.92	.35	.42	.04	.92	.18
.43	317.85	.93	.06	.43	288.75	.93	274.90
.44	.55	.94	302.77	.44	.47	.94	.63
.45	.25	.95	.48	.45	.19	.95	.36
.46	316.95	.96	.19	.46	287.91	.96	.09
.47	.65	.97	301.90	.47	.63	.97	273.82
.48	.35	.98	.61	.48	.35	.98	.54
.49	.05	.99	.32	.49	.07	.99	.27

Proportional parts for thousandths of inches.

Inches.	.001	.002	.003	.004	.005	.006	.007	.008	.009
Diff, .31	.03	.06	.09	.12	.16	.19	.22	.25	.28
,, .30	.03	.06	.09	.12	.15	.18	.21	.24	.27
,, .29	.03	.06	.09	.12	.15	.17	.20	.23	.26
,, .28	.03	.06	.08	.11	.14	.17	.20	.22	.25
,, .27	.03	.05	.08	.11	.14	.16	.19	.22	.24

TABLE II.—*(Continued.)*

Barometer Sixteen Inches.				Barometer Seventeen Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
16.00	273.00	16.50	259.64	17.00	246.67	17.50	234.08
.01	272.73	.51	.37	.01	.42	.51	233.83
.02	.46	.52	.11	.02	.16	.52	.59
.03	.19	.53	258.85	.03	245.91	.53	.34
.04	271.92	.54	.58	.04	.65	.54	.09
.05	.64	.55	.32	.05	.40	.55	232.84
.06	.37	.56	.06	.06	.14	.56	.60
.07	.10	.57	257.80	.07	244.89	.57	.35
.08	270.83	.58	.54	.08	.63	.58	.10
.09	.56	.59	.27	.09	.38	.59	231.85
16.10	270.29	16.60	257.01	17.10	244.12	17.60	231.61
.11	.02	.61	256.75	.11	243.87	.61	.36
.12	269.75	.62	.49	.12	.62	.62	.11
.13	.49	.63	.23	.13	.36	.63	230.87
.14	.22	.64	255.97	.14	.11	.64	.62
.15	268.95	.65	.71	.15	242.86	.65	.38
.16	.68	.66	.44	.16	.60	.66	.13
.17	.41	.67	.18	.17	.35	.67	229.88
.18	.14	.68	254.92	.18	.10	.68	.64
.19	267.87	.69	.66	.19	241.84	.69	.39
16.20	267.60	16.70	254.40	17.20	241.59	17.70	229.15
.21	.34	.71	.14	.21	.34	.71	228.90
.22	.07	.72	253.88	.22	.09	.72	.66
.23	266.80	.73	.62	.23	240.83	.73	.41
.24	.53	.74	.36	.24	.58	.74	.17
.25	.27	.75	.11	.25	.33	.75	227.92
.26	.00	.76	252.85	.26	.08	.76	.68
.27	265.73	.77	.59	.27	239.83	.77	.43
.28	.47	.78	.33	.28	.58	.78	.19
.29	.20	.79	.07	.29	.32	.79	226.94

TABLE II.—*(Continued.)*

Barometer Sixteen Inches.				Barometer Seventeen Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
16.30	264.93	16.80	251.81	17.30	239.07	17.80	226.70
.31	.67	.81	.55	.31	238.82	.81	.46
.32	.40	.82	.29	.32	.57	.82	.21
.33	.13	.83	.04	.33	.3 2	.83	225.97
.34	263.87	.84	250.78	.34	.07	.84	.73
.35	.60	.85	.52	.35	237.82	.85	.48
.36	.34	.86	.26	.36	.57	.86	.24
.37	.07	.87	.00	.37	.32	.87	.00
.38	262.81	.88	249.75	.38	.07	.88	224.75
.39	.54	.89	.49	.39	236.82	.89	.51
16.40	262.28	16.90	249.23	17.40	236.57	17.90	224.27
.41	.01	.91	248.98	.41	.32	.91	.02
.42	261.75	.92	.72	.42	.07	.92	223.78
.43	.48	.93	.46	.43	235.82	.93	.54
.44	.22	.94	.21	.44	.57	.94	.30
.45	260.95	.95	247.95	.45	.32	.95	.06
.46	.69	.96	.69	.46	.08	.96	222.81
.47	.43	.97	.44	.47	234.83	.97	.57
.48	.16	.98	.18	.48	.58	.98	.33
.49	259.90	.99	246.93	.49	.32	.99	.09

Proportional parts for thousandths of inches.

Inches.	.001	.002	.003	004.	.005	.006	.007	.008	.009
Diff. .28	.03	.06	.08	.11	.14	.17	.20	.22	.25
,, .27	.03	.05	.08	.11	.14	.16	.19	.22	.24
,, .26	.03	.05	.08	.10	.13	.16	.18	.21	.23
,, .25	.03	.05	.08	.10	.13	.15	.18	.20	.23
,, .24	.03	.05	.07	.10	.12	.14	.17	.19	.22

TABLE II.—*(Continued.)*

Barometer Eighteen Inches.				Barometer Nineteen Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
18.00	221.85	18.30	214.67	19.00	198.37	19.30	191.56
.01	.61	.31	.43	.01	.14	.31	.34
.02	.37	.32	.19	.02	197.91	.32	.11
.03	.12	.33	213.96	.03	.68	.33	190.89
.04	220.88	.34	.72	.04	.45	.34	.66
.05	.64	.35	.48	.05	.22	.35	.44
.06	.40	.36	.25	.06	.00	.36	.21
.07	.16	.37	.01	.07	196.77	.37	189.99
.08	219.92	.38	212.77	.08	.54	.38	.77
.09	.68	.39	.54	.09	.31	.39	.54
18.10	219.44	18.40	212.30	19.10	196.09	19.40	189.32
.11	.20	.41	.07	.11	195.86	.41	.09
.12	218.96	.42	211.83	.12	.63	.42	188.87
.13	.72	.43	.59	.13	.40	.43	.65
.14	.48	.44	.36	.14	.18	.44	.42
.15	.24	.45	.12	.15	194.95	.45	.20
.16	.00	.46	210.89	.16	.72	.46	187.98
.17	217.77	.47	.65	.17	.50	.47	.75
.18	.53	.48	.42	.18	.27	.48	.53
.19	.29	.49	.18	.19	.04	.49	.31
18.20	217.05	18.50	209.95	19.20	193.82	19.50	187.09
.21	216.81	.51	.71	.21	.59	.51	186.86
.22	.57	.52	.48	.22	.37	.52	.64
.23	.33	.53	.24	.23	.14	.53	.42
.24	.10	.54	.01	.24	192.91	.54	.20
.25	215.86	.55	208.78	.25	.69	.55	185.97
.26	.62	.56	.54	.26	.46	.56	.75
.27	.38	.57	.31	.27	.24	.57	.53
.28	.14	.58	.07	.28	.01	.58	.31
.29	214.91	.59	207.84	.29	191.79	.59	.09

TABLE II.—*(Continued.)*

Barometer Eighteen Inches.				Barometer Nineteen Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
18.60	207.61	18.80	202.96	19.60	184.86	19.80	180.46
.61	.37	.81	.73	.61	.64	.81	.24
.62	.14	.82	.50	.62	.42	.82	.02
.63	206.91	.83	.27	.63	.20	.83	179.80
.64	.67	.84	.04	.64	183.98	.84	.58
.65	.44	.85	201.81	.65	.76	.85	.36
.66	.21	.86	.58	.66	.54	.86	.14
.67	205.98	.87	.35	.67	.32	.87	178.92
.68	.74	.88	.12	.68	.09	.88	.70
.69	.51	.89	200.89	.69	182.87	.89	.49
18.70	205.28	18.90	200.66	19.70	182.65	19.90	178.27
.71	.05	.91	.43	.71	.43	.91	.05
.72	204.81	.92	.20	.72	.21	.92	177.83
.73	.58	.03	199.97	.73	181.99	.93	.61
.74	.35	.94	.74	.74	.77	.94	.39
.75	.12	.95	.51	.75	.55	.95	.18
.76	203.89	.96	.28	.76	.33	.96	176.96
.77	.66	.97	.05	.77	.11	.97	.74
.78	.42	.98	198.82	.78	180.89	.98	.52
.79	.19	.99	.59	.79	.67	.99	.31

Proportional parts for thousandths of inches.

Inches.		.001	.002	.003	.004	.005	.006	.007	.008	.009
Diff.	25.	.03	.05	.08	.10	.13	.15	.18	.20	.23
,,	24.	.03	.05	.07	.10	.12	.14	.17	.19	.22
,,	23.	.02	.05	.07	.09	.12	.14	.16	.18	.21
,,	22.	.02	.04	.07	.09	.11	.13	.15	.18	.20
,,	21.	.02	.04	.06	.08	.11	.13	.15	.17	.19

TABLE II.—*(Continued.)*

Barometer Twenty Inches.				Barometer Twenty-one Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
20.00	176.09	20.30	169.62	21.00	154.90	21.30	148.74
.01	175.87	.31	.41	.01	.69	.31	.54
.02	.66	.32	.20	.02	.49	.32	.33
.03	.44	.33	168.98	.03	.28	.33	.13
.04	.22	.34	.77	.04	.07	.34	147.93
.05	.01	.35	.56	.05	153.87	.35	.73
.06	174.79	.36	.34	.06	.66	.36	.62
.07	.57	.37	.13	.07	.46	.37	.32
.08	.36	.38	167.92	.08	.25	.38	.11
.09	.14	.39	.70	.09	.04	.39	146.91
20.10	173.92	20.40	167.49	21.10	152.84	21.40	146.71
.11	.71	.41	.28	.11	.63	.41	.50
.12	.49	.42	.06	.12	.43	.42	.30
.13	.28	.43	166.85	.13	.22	.43	.10
.14	.06	.44	.64	.14	.01	.44	145.90
.15	172.84	.45	.43	.15	151.81	.45	.69
.16	.63	.46	.21	.16	.60	.46	.49
.17	.41	.47	.00	.17	.40	.47	.29
.18	.20	.48	165.79	.18	.19	.48	.09
.19	171.98	.49	.68	.19	150.99	.49	144.88
20.20	171.77	20.50	165.37	21.20	150.78	21.50	144.68
.21	.55	.51	.15	.21	.58	.51	.48
.22	.34	.52	164.94	.22	.37	.52	.28
.23	.12	.53	.73	.23	.17	.53	.08
.24	170.91	.54	.52	.24	149.97	.54	143.87
.25	.69	.55	.31	.25	.76	.55	.67
.26	.48	.56	.10	.26	.56	.56	.47
.27	.27	.57	163.89	.27	.35	.57	.27
.28	.05	.58	.67	.28	.15	.58	.07
.29	169.84	.59	.46	.29	148.94	.59	142.87

TABLE II.—*(Continued.)*

Barometer Twenty Inches.				Barometer Twenty-one Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
20.60	163.25	20.80	159.06	21.60	142.67	21.80	138.66
.61	.04	.81	158.85	.61	.47	.81	.46
.62	162.83	.82	.64	.62	.26	.82	.27
.63	.62	.83	.43	.63	.06	.83	.07
.64	.41	.84	.22	.64	141.86	.84	137.87
.65	.20	.85	.01	.65	.66	.85	.67
.66	161.99	.86	157.81	.66	.46	.86	.47
.67	.73	.87	.60	.67	.26	.87	.27
.68	.57	.88	.39	.68	.06	.88	.07
.69	.36	.89	.18	.69	140.86	.89	136.87
20.70	161.15	20.90	156.97	21.70	140.66	21.90	136.68
.71	160.94	.91	.77	.71	.46	.91	.48
.72	.73	.92	.56	.72	.26	.92	.28
.73	.52	.93	.35	.73	.06	.93	.08
.74	.31	.94	.14	.74	139.86	.94	135.88
.75	.10	.95	155.94	.75	.66	.95	.69
.76	159.89	.96	.73	.76	.46	.96	.49
.77	.68	.97	.52	.77	.26	.97	.29
.78	.47	.98	.31	.78	.06	.98	.09
.79	.27	.99	.11	.79	138.86	.99	134.89

Proportional parts for thousandths of inches.

Inches.	.001	.002	.003	.004	.005	.006	.007	.008	.009
Diff. .22	.02	.04	.07	.09	.11	.13	.15	.18	.20
,, .21	.02	.04	.06	.08	.11	.13	.15	.17	.19
,, .20	.02	.04	.06	.08	.10	.12	.14	.16	.18
,, .19	.02	.04	.06	.08	.10	.11	.13	.15	.17

TABLE II.—*(Continued.)*

Barometer Twenty-two Inches.				Barometer Twenty-three Inches.			
Inches.	Factor.	Inches	Factor.	Inches.	Factor.	Inches.	Factor.
22.00	134.70	22.30	128.82	23.00	115.39	23.30	109.76
.01	.50	.31	.62	.01	.20	.31	.58
.02	.30	.32	.43	.02	.01	.32	.39
.03	.11	.33	.23	.03	114.83	.33	.21
.04	133.91	.34	.04	.04	.64	.34	.02
.05	.71	.35	127 84	.05	.45	.35	108.83
.06	.51	.36	.65	.06	.26	.36	.65
.07	.32	.37	.45	.07	.07	.37	.46
.08	.12	.38	.26	.08	113.88	.38	.28
.09	132.92	.39	.07	.09	.70	.39	.09
22.10	132.73	22.40	126.87	23.10	113.51	23.40	107.90
.11	.53	.41	.68	.11	.32	.41	.72
.12	.33	.42	.48	.12	.13	.42	.53
.13	.14	.43	.29	.13	112.94	.43	.35
.14	131.94	.44	.10	.14	.76	.44	.16
.15	.75	.45	125.90	.15	.57	.45	106.98
.16	.55	.46	.71	.16	.38	.46	.79
.17	.35	.47	.52	.17	.19	.47	.61
.18	.16	.48	.32	.18	.01	.48	.42
.19	130.96	.49	.13	.19	111.82	.49	.24
22.20	130.77	22.50	124.94	23.20	111.63	23.50	106.05
.21	.57	.51	.74	.21	.44	.51	105.87
.22	.38	.52	.55	.22	.26	.52	.68
.23	.18	.53	.36	.23	.07	.53	.50
.24	129.99	.54	.17	.24	110.88	.54	.31
.25	.79	.55	123.97	.25	.70	.55	.13
.26	.59	.56	.78	.26	.51	.56	104.94
.27	.40	.57	.59	.27	.32	.57	.76
.28	.20	.58	.40	.28	.14	.58	.58
.29	.01	.59	.20	.29	109.95	.59	.39

TABLE II.—*(Continued.)*

Barometer Twenty-two Inches.				Barometer Twenty-three Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
22.60	123.01	22.80	119.19	23.60	104.21	23.80	100.54
.61	122.82	.81	118.99	.61	.02	.81	.36
.62	.63	.82	.80	.62	103.84	.82	.18
.63	.44	.83	.61	.63	.66	.83	.00
.64	.24	.84	.42	.64	.47	.84	99.81
.65	.05	.85	.23	.65	.29	.85	.63
.66	121.86	.86	.04	.66	.11	.86	.45
.67	.67	.87	117.85	.67	102.92	.87	.27
.68	.48	.88	.66	.68	.74	.88	.09
.69	.29	.89	.47	.69	.55	.89	98.90
22.70	121.09	22.90	117.28	23.70	102.37	23.90	98.72
.71	120.90	.91	.09	.71	.19	.91	.54
.72	.71	.92	116.91	.72	.01	.92	.36
.73	.52	.93	.72	.73	101.82	.93	.18
.74	.33	.94	.53	.74	.63	.94	.00
.75	.14	.95	.34	.75	.44	.95	97.81
.76	119.95	.96	.15	.76	.26	.96	.63
.77	.76	.97	115.96	.77	.07	.97	.45
.78	.57	.98	.77	.78	100.99	.98	.27
.79	.38	.99	.58	.79	.71	.99	.09

Proportional parts for thousandths of inches.

Inches.		.001	.002	.003	.004	.005	.006	.007	.008	.009
Diff.	.20	.02	.04	.06	.08	.10	.12	.14	.16	.18
,,	.19	.02	.04	.06	.08	.10	.11	.13	.15	.17
,,	.18	.02	.04	.05	.07	.09	.11	.13	.14	.16

TABLE II.—*(Continued.)*

Barometer Twenty-four Inches.				Barometer Twenty-five Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
24.00	96.91	24.30	91.51	25.00	79.18	25.30	74.00
.01	.73	.31	.33	.01	.01	.31	73.83
.02	.55	.32	.16	.02	78.83	.32	.66
.03	.37	.33	90.98	.03	.66	.33	.48
.04	.19	.34	.80	.04	.49	.34	.31
.05	.00	.35	.62	.05	.31	.35	.14
.06	95.82	.36	.44	.06	.14	.36	72.97
.07	.64	.37	.26	.07	77.97	.37	.80
.08	.46	.38	.09	.08	.79	.38	.63
.09	.28	.39	89.91	.09	.62	.39	.46
24.10	95.10	24.40	89.73	25.10	77.45	25.40	72.29
.11	94.92	.41	.55	.11	.27	.41	.12
.12	.74	.42	.37	.12	.10	.42	71.94
.13	.56	.43	.20	.13	76.93	.43	.77
.14	.38	.44	.02	.14	.75	.44	.60
.15	.20	.45	88.84	.15	.58	.45	.43
.16	.02	.46	.66	.16	.41	.46	.26
.17	93.84	.47	.49	.17	.24	.47	.09
.18	.66	.48	.31	.18	.06	.48	70.92
.19	.48	.49	.13	.19	75.89	.49	.75
24.20	93.30	24.50	87.95	25.20	75.72	25.50	70.58
.21	.13	.51	.78	.21	.55	.51	.41
.22	92.95	.52	.60	.22	.37	.52	.24
.23	.77	.53	.42	.23	.20	.53	.07
.24	.59	.54	.25	.24	.03	.54	69.90
.25	.41	.55	.07	.25	74.86	.55	.73
.26	.23	.56	86.89	.26	.69	.56	.56
.27	.05	.57	.71	.27	.51	.57	.39
.28	91.87	.58	.54	.28	.34	.58	.22
.29	.69	.59	.36	.29	.17	.59	.05

TABLE II.—*(Continued.)*

Barometer Twenty-four Inches.				Barometer Twenty-five Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
24.60	86.18	24.80	82.67	25.60	68.88	25.80	65.50
.61	.01	.81	.49	.61	.71	.81	.33
.62	85.83	.82	.32	.62	.54	.82	.16
.63	.66	.83	.14	.63	.37	.83	.00
.64	.48	.84	81.97	.64	.20	.84	64.83
.65	.30	.85	.79	.65	.03	.85	.66
.66	.13	.86	.62	.66	67.86	.86	.49
.67	84.95	.87	.44	.67	.69	.87	.32
.68	.77	.88	.27	.68	.52	.88	.16
.69	.60	.89	.10	.69	.36	.89	63.99
24.70	84.42	24.90	80.92	25.70	67.19	25.90	63.82
.71	.25	.91	.75	.71	.02	.91	.65
.72	.07	.92	.57	.72	66.85	.92	.48
.73	83.90	.93	.40	.73	.68	.93	.32
.74	.72	.94	.22	.74	.51	.94	.15
.75	.54	.95	.05	.75	.34	.95	62.98
.76	.37	.96	79.88	.76	.17	.96	.82
.77	.19	.97	.70	.77	.01	.97	.65
.78	.02	.98	.53	.78	65.84	.98	.48
.79	82.84	.99	.35	.79	.67	.99	.31

Proportional parts for thousandths of inches.

Inches.		.001	.002	.003	.004	.005	.006	.007	.008	.009
Diff	.19	.02	.04	.06	.08	.10	.11	.13	.15	.17
,,	.18	.02	.04	.05	.07	.09	.11	.13	.14	.16
,,	.17	.02	.03	.05	.07	.09	.10	.12	.14	.15
,,	.16	.02	.03	.05	.06	.08	.10	.11	.13	.14

TABLE II.—*(Continued.)*

Barometer Twenty-six Inches.				Barometer Twenty-seven Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
26.00	62.15	26.30	57.16	27.00	45.76	27.30	40.96
.01	61.98	.31	.00	.01	.60	.31	.80
.02	.81	.32	56.83	.02	.43	.32	.64
.03	.65	.33	.67	.03	.27	.33	.48
.04	.48	.34	.50	.04	.11	.34	.32
.05	.31	.35	.34	.05	44.95	.35	.16
.06	.15	.36	.17	.06	.79	.36	.00
.07	60.98	.37	.01	.07	.63	.37	39.85
.08	.81	.38	55.85	.08	.47	.38	.59
.09	.65	.39	.68	.09	.31	.39	.53
26.10	60.48	26.40	55.52	27.10	44.15	27.40	39.37
.11	.31	.41	.35	.11	43.99	.41	.21
.12	.15	.42	.19	.12	.83	.42	.05
.13	59.98	.43	.02	.13	.67	.43	38.89
.14	.81	.44	54.86	.14	.51	.44	.74
.15	.65	.45	.69	.15	.35	.45	.58
.16	.48	.46	.53	.16	.19	.46	.42
.17	.32	.47	.37	.17	.03	.47	.26
.18	.15	.48	.20	.18	42.87	.48	.10
.19	58.98	.49	.04	.19	.71	.49	37.95
26.20	58.82	26.50	53.87	27.20	42.55	27.50	37.79
.21	.65	.51	.71	.21	.39	.51	.63
.22	.49	.52	.55	.22	.23	.52	.47
.23	.32	.53	.38	.23	.07	.53	.31
.24	.16	.54	.22	.24	41.91	.54	.16
.25	57.99	.55	.06	.25	.75	.55	.00
.26	.83	.56	52.89	.26	.59	.56	36.84
.27	.66	.57	.73	.27	.43	.57	.68
.28	.49	.58	.66	.28	.28	.58	.63
.29	.33	.59	.40	.29	.12	.59	.37

TABLE II.—*(Continued.)*

Barometer Twenty-six Inches.				Barometer Twenty-seven Inches.			
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
26.60	52.24	26.80	48.99	27.60	36.21	27.80	33.08
.61	.08	.81	.82	.61	.05	.81	32.92
.62	51.91	.82	.66	.62	35.90	.82	.76
.63	.75	.83	.50	.63	.74	.83	.61
.64	.59	.84	.34	.64	.58	.84	.45
.65	.42	.85	.18	.65	.42	.85	.29
.66	.26	.86	.01	.66	.27	.86	.14
.67	.10	.87	47.85	.67	.11	.87	31.98
.68	50.93	.88	.69	.68	34.95	.88	.83
.69	.77	.89	.53	.69	.80	.89	.67
26.70	50.61	26.90	47.37	27.70	34.64	27.90	31.52
.71	.45	.91	.21	.71	.48	.91	.36
.72	.28	.92	.04	.72	.33	.92	.20
.73	.12	.93	46.88	.73	.17	.93	.05
.74	49.96	.94	.72	.74	.01	.94	30.89
.75	.80	.95	.56	.75	33.86	.95	.74
.76	.63	.96	.40	.76	.70	.96	.58
.77	.47	.97	.24	.77	.54	.97	.43
.78	.31	.98	.08	.78	.39	.98	.27
.79	.15	.99	45.92	.79	.23	.99	.12

Proportional parts for thousandths of Inches.

Inches.	.001	.002	.003	.004	.005	.006	.007	.008	.009
Diff. .17	.02	.03	.05	.07	.09	.10	.12	.14	.15
„ .16	.02	.03	.05	.06	.08	.10	.11	.13	.14
„ .15	.01	.03	.04	.06	.08	.09	.11	.12	.14

TABLE II.—*Factor of the Barometers.*

Barometer Twenty-eight Inches.				Barometer Twenty-nine Inches.				Barometer Thirty Inches.	
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
28.00	29.96	28.30	25.33	29.00	14.72	29.30	10.25	30.00	0.00
.01	.81	.31	.18	.01	.57	.31	.10	.01	.14
.02	.65	.32	.03	.02	.42	.32	9.96	.02	.29
.03	.50	.33	24.87	.03	.27	.33	.81	.03	.44
.04	.34	.34	.72	.04	.12	.34	.66	.04	.58
.05	.19	.35	.57	.05	13.97	.35	.51	.05	.72
.06	.03	.36	.41	.06	.82	.36	.36	.06	.87
.07	28.88	.37	.26	.07	.67	.37	.22	.07	1.01
.08	.72	.38	.11	.08	.53	.38	.07	.08	.16
.09	.57	.39	23.95	.09	.38	.39	8.92	.09	.30
28.10	28.41	28.40	23.80	29.10	13.23	29.40	8.77	30.10	1.45
.11	.26	.41	.65	.11	.08	.41	.62	.11	.59
.12	.10	.42	.50	.12	12.93	.42	.48	.12	.74
.13	27.95	.43	.34	.13	.78	.43	.33	.13	.88
.14	.80	.44	.19	.14	.63	.44	.18	.14	2.02
.15	.64	.45	.04	.15	.48	.45	.03	.15	.17
.16	.49	.46	22.89	.16	.33	.46	7.89	.16	.31
.17	.33	.47	.73	.17	.18	.47	.74	.17	.46
.18	.18	.48	.58	.18	.03	.48	.59	.18	.60
.19	.02	.49	.43	.19	11.89	.49	.45	.19	.74
28.20	26.87	28.50	22.28	29.20	11.74	29.50	7.30	30.20	2.89
.21	.72	.51	.12	.21	.59	.51	.15	.21	3.03
.22	.56	.52	21.97	.22	.44	.52	.00	.22	.17
.23	.41	.53	.82	.23	.29	.53	6.86	.23	.32
.24	.26	.54	.67	.24	.14	.54	.71	.24	.46
.25	.10	.55	.51	.25	10.99	.55	.56	.25	.61
.26	25.95	.56	.36	.26	.85	.56	.42	.26	.75
.27	.79	.57	.21	.27	.70	.57	.27	.27	.89
.28	.64	.58	.06	.28	.55	.58	.12	.28	4.04
.29	.49	.59	20.91	.29	.40	.59	5.97	.29	.18

TABLE II.—*(Continued.)*

Barometer Twenty-eight Inches.				Barometer Twenty-nine Inches.				Barometer Thirty Inches.	
Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.	Inches.	Factor.
28.60	20.75	28.80	17.73	29.60	5.83	29.80	2.90	30.30	4.32
.61	.60	.81	.58	.61	.68	.81	.76	.31	.47
.62	.45	.82	.43	.62	.53	.82	.61	.32	.61
.63	.30	.83	.28	.63	.39	.83	.47	.33	.75
.64	.15	.84	.12	.64	.24	.84	.32	.34	.90
.65	.00	.85	16.97	.65	.10	.85	.18	.35	5.04
.66	19.84	.86	.82	.66	4.95	.86	.03	.36	.18
.67	.69	.87	.67	.67	.80	.87	1.88	.37	.32
.68	.54	.88	.52	.68	.66	.88	.74	.38	.47
.69	.39	.89	.37	.69	.51	.89	.59	.39	.61
28.70	19.24	28.90	16.22	29.70	4.36	29.90	1.45	30.40	5.75
.71	.09	.91	.07	.71	.22	.91	.30	.41	.90
.72	18.94	.92	15.92	.72	.07	.92	.16	.42	6.04
.73	.78	.93	.77	.73	3.93	.93	.01	.43	.18
.74	.63	.94	.62	.74	.78	.94	0.87	.44	.32
.75	.48	.95	.47	.75	.63	.95	.72	.45	.47
.76	.33	.96	.32	.76	.49	.96	.58	.46	.61
.77	.18	.97	.17	.77	.34	.97	.43	.47	.75
.78	.03	.98	.02	.78	.20	.98	.29	.48	.89
.79	17.88	.99	14.87	.79	.05	.99	.14	.49	7.04

Proportional parts for thousandths of inches.

Inches.	.001	.002	.003	.004	.005	.006	.007	.008	.009
Diff. .16	.02	.03	.05	.06	.08	.10	.11	.13	.14
,, .15	.02	.03	.05	.06	.08	.09	.11	.12	.14
,, .14	.01	.03	.04	.06	.07	.08	.10	.11	.13

TABLE III.—*Factors for the sum of the detached Thermometers.*

Sum.	Factor.
40	58.74
50	59.41
60	60.08
70	60.75
80	61.42
90	62.09
100	62.76
110	63.43
120	64.10
130	64.77
140	65.44
150	66.11
160	66.78
170	67.45
180	68.12
190	68.79
200	69.46

Difference for single Degrees.

1	0.07
2	0.13
3	0.20
4	0.27
5	0.34
6	0.40
7	0.47
8	0.54
9	0.60

TABLE IV.—*Correction for Latitude.*

Altitude in Feet.	Latitude.						
	0	10	20	25	30	35	40
	Correction in feet additive.						
1000	3	3	2	2	1	1	0
2000	5	5	4	3	3	2	1
3000	8	8	6	5	4	3	1
4000	11	10	8	7	5	4	2
5000	13	13	10	9	7	5	2
6000	16	15	12	10	8	6	3
7000	19	18	14	12	9	6	3
8000	22	20	17	14	11	7	4
9000	24	23	19	16	12	8	4
10000	27	25	21	17	13	9	5
11000	30	28	23	19	15	10	5
12000	32	30	25	21	16	11	6
13000	35	33	27	23	18	12	6
14000	38	35	29	24	19	13	7
15000	40	38	31	26	20	14	7
16000	43	41	33	28	21	15	7
17000	46	43	35	29	23	16	8
18000	49	46	37	31	24	17	8
19000	51	48	39	33	26	18	9
	Correction in feet, subtractive						
	90	80	70	65	60	55	50
	Latitude.						

On the Encrustation of Steam Boilers and Pipes in India.—By Dr. Geo. Buist, *Bombay.*

A very serious source of annoyance to the Steam Engineer in India is the extreme rapidity with which encrustations collect in the recesses of flues, and around the tubes of steam boilers. These often accumulate in parts of the boiler difficult of access, to the thickness of an inch in the course of a year—they intercept heat, diminish the generation of steam, and by permitting the temperature of the iron outside to get high, with a non-conducting substance, rapidly cause oxidation. The crust generally consists of sulphate and carbonate of lime, with a large portion of dried sea salt. The greatest inconvenience is felt with tube boilers. I have known the whole of the tubes burnt out in six months' time, and have seen them, when placed too close to each other, cemented into a solid mass, with the stony matter between. The stony matter consists of sulphate and carbonate of lime, with a very large proportion of sea salt, hardened by the great heat of the flues and tubes when the boiler is emptied too soon after the fires are drawn.

The remedies proposed for this unfortunate state of things are very numerous; none of them have, I believe, proved so successful as might have been desired. I have suggested the expediency of running off the brine leisurely, and filling up the boiler either with sea water not concentrated by boiling, or with fresh water, where this was accessible, so as by these means to get rid of the soluble part of the crust, when the earthy portion, deprived of this, would become so friable and spongy as to drop off.

Dr. Giraud has suggested hanging portions of broken crust in bags inside the boiler, in hopes of affording a nucleus of deposition preferable to that provided by the tubes or the boilers themselves.

The Engineers get quit of the crust when it is thin by running off the boilers, and allowing the encrustation to become perfectly dry. When cold, a sudden blaze of chips is lighted in the furnace, by which means the crustings inside crack and drop off. When they grow thick and troublesome, workmen are sent inside the boiler to chop them off.

A curious variety of metallic deposit sometimes occurs on the steam pipe, close to its connection with the cylinder, when the boiler is of iron, the pipe of copper or mixed metal containing copper, a specimen of this accompanies this paper.* It is about half an inch thick, and consists of alternate layers of pure copper, about forty in number, and of copper slightly oxydized. This was found in the steam pipe of the P. and O. S. N. Co.'s Steamer Pekin, which connected the fore and after boilers together: the boilers are iron, the connecting pipe copper. There is a considerable scale of rust on the plate through which the pipe passes: there are lead joints between the copper and the iron, to prevent or diminish the action of the metals on each other. The copper crust was found immediately inside the stop valves and extended about a foot into the pipe. The same action is believed to be going on in all the copper pipes, but in this case it was collected by the self-action stop valves: in the other cases the cupreous solution flowed into the boiler or cylinder, and was lost. For the specimen now sent I am indebted to Captain Gribble, and for the information regarding it to Captain Baker, of the Pekin.

It is quite clear here that a complex series of chemical processes must have been going on to produce this beautiful specimen of Electrotype copper, which was soft, and cut like black lead when first received, though it has now assumed its proper hardness. We must first have had the copper dissolved by the steam or water in the pipe, the solution collected beyond the stop valve must have been revived by galvanic action induced by the copper and iron on each other. It is probable that each layer was due to a single working of the boilers, and that the open film between was produced when the steam was down. No similar deposit has ever been met with by any of the Engineers I have seen.

* Deposited in the Museum of the Asiatic Society.—Eds.

PROCEEDINGS

OF THE

ASIATIC SOCIETY OF BENGAL

FOR JUNE, 1850.

At a Meeting of the Asiatic Society of Bengal held on the 5th June, 1850,

The Hon'ble Sir J. W. COLVILE, President, in the Chair,

The proceedings of the May Meeting were read and confirmed.

Letters were read—

From G. A. Bushby, Esq. and Lieut. A. G. Austen, intimating their desire to withdraw from the Society.

From J. Thornton, Esq., Secretary to the Government of the North Western Provinces, enclosing, in original, the first 70 paragraphs of a Report on the Statistics of the Banda district, drawn up by Mr. M. P. Edgeworth, Esq. C. S. Ordered for publication in the Journal.

From Munshi Nizam-Ud-dín of Poonah, offering his services to the Society as a translator, and forwarding a copy of a Hindustání work by him, entitled Insha-i-Hindi.

From Captain J. C. Hannyngton, submitting a set of Tables for computing heights by the Barometer.

From Rev. J. Long, soliciting copies of the Bibliotheca Indica for ten Vernacular Libraries established by the Church Missionary Society, in Calcutta, Krishnaghur and Burdwan.

Ordered that the subject be brought forward for consideration at the next meeting, and that in the meantime, Rev. Mr. Long be requested to send in an official letter regarding it.

From Captain Thuillier, offering copy of a Map of Sikkim and Eastern Nepaul, by Dr. J. D. Hooker, for publication in the Society's Journal.

Ordered that the Secretary and the Finance Committee consider and report as to the expense of publishing it in the Journal.

From W. Seton Karr, Esq., Under Secretary to the Government of Bengal, regarding an application of the Statistical Section of the Society, for permission to have access to the Index to the records of the Bengal Secretary's Office.

From the Under Secretary to the Government of Bengal,

To the Vice President and Secretary to the Asiatic Society.

Dated Fort William, the 8th May, 1850.

Sir,—I am directed by the Deputy Governor of Bengal to acknowledge the receipt of your letter, dated the 27th March last, submitting a solicitation, on the part of the Statistical Section of the Asiatic Society, for permission to have access to the records of the Bengal Secretary's Office, with a view to the publication of it's Indices.

2. His honor regrets that he is unable to comply with the above request.

I have the honor to be, Sir,
Your most Obedient Servant,
W. Seton Karr.
Under Secy. to the Govt. of Bengal.

From P. B. Reid, Esq. Secretary to the Agra Local Agency, enclosing a memorandum of five gold coins, lately dug out of a ruin in the vicinity of the Agra Fort, and enquiring whether the Society would like to purchase them.

Resolved, that the Society does not consider it desirable to purchase the coins.

From Captain H. L. Thuillier, Deputy Surveyor General, forwarding Tables of the monthly means of Maximum and Minimum Pressures from 1840 to 1849, taken from the Meteorological Register kept at the Surveyor General's Office, Calcutta.

From Mauluvi Golám Akbar, late Persian Librarian, praying for a testimonial for his past services to the Society.

Resolved, that the Secretary be desired to grant the request of the Mauluvi.

From Dr. E. Roer, Secretary to the Oriental Section, recommending on the part of the Section, the publication of a translation of the Ch'handogya Upanishad by Bábu Rájendralal Mittra.

Ordered for publication in the Bibliotheca Indica.

From the same, the subjoined letter, in reply to a reference from the Society, regarding the Section's report of the 1st. April last.

To Captain F. Hayes, *Secretary, Asiatic Society.*

Sir,—By direction of the Oriental Section, I have the honour to return, for the orders of the Council and the Society, my Report of the 1st April last on Oriental Publications, referred for the reconsideration of the Section, and to state, that the Section would recommend, that the publication of texts should proceed, and the translations follow as soon as practicable.

2. I beg to observe, that in proposing so many texts for publication it was not intended, that all of them should be printed with the exclusion of other important works, which might hereafter be proposed by other scholars, but that sufficient time should be given to obtain good MSS. to examine and to compare them. Without this we would not be able to publish editions worthy of the high standing of our Society. The necessity of an early selection will be evident from the fact, that the Library of the Asiatic Society hardly contains one MS. fit for printing, and that, had I not been assisted by MSS. procured either from public collections, or private individuals, I would not have succeeded in publishing even one of the works already printed. I may perhaps not be able to collect a third of the works proposed, and on their collection the MSS. may prove so bad as to preclude the hope of their early publication. Of the works enumerated in the list, only two are prepared for printing, viz. the Uttara Naishadha, of which I have procured a sufficient number of MSS., and the Bháshá Parich'héda of which the translation is ready.

3. I have the honour to lay before the Society abstracts of interesting letters, received from Messrs. Lassen, Burnouf and Müeller, on our publications, and I hope, that the discussion, which at the April meeting took place on the mode of my publishing, may serve as an apology for not having omitted the flattering expressions about myself.

I have the honour to be, Sir,

Your most obedient servant,

E. Roer.

Secy. Asiatic Society, Oriental Department.

Howrah, the 1*st June,* 1850.

To Dr. W. B. O'Shaughnessy, *Senior Secretary of the Asiatic Society.*

Sir,—The publication of the Upanishads, which are accompanied with a commentary of S'ankara A'chárya, being nearly completed, I have the honour, by direction of the Oriental Section, to propose, for the consideration and orders of the Council and Society, the gradual publication of the following works in the Bibliotheca Indica:

1. The Uttara Naishadha, or the second part of the Naishadha, together with the commentary of Náráyan Pandit.
2. Tha Vaishéika Sútras with the commentary of Sri Sankara.
3. The Bháshá Parich'héda with an English translation.
4. A selection from the best Dramas in Sanskrit, not yet published.
5. The Puránas.
6. The most important Astronomical works of the Hindus, and at first Varáhamíhira's Várábi Sanhitá and Pancha Siddhantas, if these works can be obtained.
7. Nala Champu.
8. Bhoja Champu.
9. Bharata Champu.
10. Rághava Pándavíya.
11. Anargha Rághava.

By the completion of the Naishadha the Society, who published the first part in 1836, would gratify the wishes of the Oriental scholars in Europe as well as in India. As Prem Chander Pandit of the Sanskrit College in Calcutta, who has written the commentary to the first part of this work, is not prepared to furnish us with a commentary to the second, the Section proposes, that the Tiká of Náráyan Pandit, one of the oldest and best commentaries, be added to the text.

The Sútras of Kanáda deserve also the early patronage of the Society, as no work of the Vaishésika school of philosophy has yet been printed.

The Society, some years ago, sanctioned the publication of the text of the Bháshá Parich'héda together with an English translation which I had prepared. This translation, as the Society will recollect, was lost by the transfer of papers from the former Secretary's office. I have since revised a rough copy, and have now the pleasure to offer it to the Society for publication, together with the preface and text, in the Bibliotheca Indica.

2. It is further proposed: 1.—That every three months copies of the Bibliotheca should be sent to those Societies and scholars to whom they were presented before. 2.—That 25 copies should be, regularly every month, transmitted to Messrs. Allen and Co., complaints having reached us, that no copies are for sale in Europe. 3.—That a certain number of copies should

be forwarded to the School-Book-Societies in Allahabad and Agra, and to booksellers in Bombay and Madras, for sale on account of the Society.

3. The Section beg to recommend the purchase of the accompanying MS., containing a Persian translation of the Upanishads, which has been offered to the Society at the price of 12 Rupees.

I have the honour to be, Sir,

Your most obedient servant,

E. Roer,

Secretary, Oriental Section, Asiatic Society.

Howrah, the 1*st April*, 1850.

Resolved, that the Society adopt the proposition of the Oriental Section regarding the publication of the Uttara Naishadha and Bhásha Parich'héda, and for the transmission of the copies proposed to be sent to Messrs. Allen and Co., and to the bodies and persons to whom copies of the Bibliotheca Indica have hitherto been sent, and refers it to the Oriental Section to consider and report, whether the list of bodies and persons to whom that publication is now sent, may, to any, or what extent, be usefully enlarged.

From John Barlow, Esq., Secretary to the Royal Institution of Great Britain, acknowledging receipt of No. 206 of the Journal, presented to that Institution by the Society.

From D. Edward Ruppell, Esq., Frankfort, offering a set of his Zoological works in exchange for a set of the Transactions of the Society.

Ordered that the Secretary communicate to Mr. Ruppell, that a set of the Asiatic Researches from VI. @ XX. (the first five volumes being out of print) will be forwarded to Messrs. Allen and Co. to whom he may send his works for the Society.

From George Balfour, Esq., Magistrate of Monghyr, regarding the gold coins submitted to the Society for inspection, by Mr. Cunliffe.

The coins were ordered to be returned to Mr. Balfour.

From Dr. E. Roer, Secretary, Oriental Section, recommending that an English translation of the Lalita Vistara submitted to the Section by Bábu Rajcndralál Mittra, be published in the Bibliotheca Indica.

Resolved unanimously, that the recommendation of the Oriental Section be adopted.

From the same, proposing that the Rev. Principal Kay of Bishop's College, be elected a member of the Oriental Section.

On the question being put to the vote Rev. W. Kay was unanimously elected.

From Col. J. Low, Penang, announcing despatch of a collection of MSS. and Antiquities per "Erin," for the Society.

The Zoological Curator and Librarian having submitted their reports the Society adjourned.

Read and confirmed, 3rd July, 1850.

J. W. Colvile, *President.*

Fletcher Hayes, *Secretary.*

Report of Curator, Zoological Department, for June Meeting, 1850.

Sir,—I have to announce the presentations of a rare Australian Parrakeet (*Psephotus hæmatonotus*, Gould), by Capt. Lewis of the Barque 'Tenasserim,' and of the carcass of a Bara Singha doe (*Cervus Duvaucelie*, Cuv.), by Bábu Rájendra Mallika.

And I have personally the pleasure of presenting the Society with skeletons of the Peruvian Llama, Snowy Owl, Crowned Crane, and Hooper Swan. Also with a collection of some of the more shewy Brazilian *Paperes* (chiefly *Pipræ*, *Tanagræ*, and *Trochilidæ*), adding 38 species to our bird collection; and with an extensive series of land, fresh-water and marine Australian shells.

Lastly, I may mention that I have succeeded in procuring for the Museum, skeletons of both sexes of a species of Ca'ing Whale (*Globicephalus*,) in form and size resembling the European *Gl. deductor*, but wholly of a deep black colour. A shoal of these animals numbering about 20, was carried by an extraordinary high tide, into the salt-water lakes eastward of Calcutta, where several of them lived many days, floundering about in the shallow-water; and in this situation I had repeated opportunities of witnessing the expiration from the spiracle within the distance of a few feet, no jet of water of course being thrown up, but a very visible discharge of aqueous particles, as from a wet syringe, and this while the spiracle remained above water.

I have the honour to be, Sir,

Your's obediently,

E. Blyth.

Asiatic Society's Rooms, June 1st, 1850.

Library.

The following books have been added to the library since the last meeting.

Presented.

On the Vegetation of the Galapagos Archipelago as compared with that

of some other Tropical Islands and of the Continent of America. By Dr. J. D. Hooker. (Pamphlet.)—Presented by the Author.

Journal of the Academy of Natural Sciences of Philadelphia, Vol. I. Part IV.—Presented by the Academy.

Systematisches Verzeichniss der naturhistorischen Sammlung der Gesellschaft Museum. Erste abthielung. Voegel. Bremen, 1844, 4to.—By Dr. G. Hartlaub.

Systematischer Index zu Don Felix de Azara's Apuntamientos para la historia natural d los paxaros del Paraguay y Rio de la Plata. Von Dr. G. Hartlaub. Bremen, 1847, demi 4to.—By the Author.

Erstes Nachtrag zum Verzeichniss der Vogelsammlung des Museums. (Pamphlet.)—By Dr. G. Hartlaub.

Wanderings in the Islands of Interview (Andaman) Little and Great Coco. By J. H. Quigley, Esq. Maulmain, 1850, 12mo. Pamphlet.--By the Author.

Fontana on Poisons, 2 vols. 8vo.—By Dr. W. B. O'Shaughnessy.

Mead on Poisons, 1 vol. 8vo.—By the Same.

Catalogue des Coins et Medaelles du Musee Monitaire de la Commission des Monnaire et Medailles, Paris, 1833, 8vo.—By the Same.

Journal of the Agri-Horticultural Society of India, Nos. X.-XI. of Vol. II. and Part II. Vol. VI.—By the Same.

Calcutta Journal of Natural History, Nos. 1, 3, (two copies) 10, 11, 12, 14, and 17.—By the Same.

Griffin's Scientific Miscellany, No. VI. The Geology of the Island of Arran, from Original Survey. By A. C. Ramsey, (2 copies).—By the Same.

Insha i Hindi, being a collection of some hundreds of letters and petitions, &c. with an entire translation of the Inshá i Harkaran. By Munshi Nizám Uddin. Bombay, 1850, 8vo.—By the Author.

Meteorological Register kept at the Surveyor General's Office, Calcutta, for the month of April, 1850.—By the Deputy Surveyor General.

The Oriental Baptist, Nos. 41-2.—By the Editor.

The Upadeshaka, Nos. 41-2.—By the Editor.

The Oriental Christian Spectator for April, 1850.—By the Editor.

Calcutta Christian Observer for May and June, 1850.—By the Editor.

Exchanged.

The Athenæum, Nos. 1165·7-9-70-71-72.

Purchased.

The Kádamvari, edited by Pandit Madanmohan Tarkalankár, Vol. II. Calcutta, 1850, 8vo. 5 copies.

The Annals and Magazine of Natural History, No. 27.